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# THE
# CANADIAN JOURNAL
# OF
# INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES.

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VOL. VII.

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⁂ *Communications for the Journal to be addressed to the General Editor,* PROFESSOR CHAPMAN, *University College, Toronto.*

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# THE CANADIAN JOURNAL.

NEW SERIES.

No. XXXVII.—JANUARY, 1862.

## THE PRESIDENT'S ADDRESS.

BY THE HON. J. H. HAGARTY, D.C.L.,
JUDGE OF THE COURT OF COMMON PLEAS.

*Read before the Canadian Institute, January* 18, 1862.

A master of English prose has told us how he found in an old writer, a quaint apologue, in which human life is symbolized by a vast board pierced with innumerable openings of every size and figure, —circular, square, obtuse and acute angled.

Every denizen of the earth has there his fitting opening—if he can only find it. But some maladroit influence has arranged the occupants, and, as the author says, feelingly, "How often do we see the round man in the three-cornered hole?"

The occupation of the chair this evening may possibly revive this pleasant fable in many memories, as it certainly has in mine. I can but console myself by the thought that, like thousands of others similarly situated, I am but in a secondary degree responsible for the misplacement.

The custom of the Society calls upon me for a few introductory remarks on assuming the position with which I have been honoured. The short space in which I intend to trespass on your patience, must be occupied in viewing the topics suggested by the occasion, from a stand-point outside the charmed circle of Science and Art, so worthily occupied by our more distinguished members. I may be reproached for my deficiencies by the well-known saying of Finch, "The sparks of all the Sciences may be raked from the ashes of the Law," but we have few amongst us here to whom we can point as an illustration of this tribute to a profession—which first merited the compliment in Francis Bacon, and still claims it for Henry Brougham.

In a retrospect of the past year in any Institute for the Promotion of Science or Art throughout the vast domains of Britain, an earnest sorrow must find an early utterance for the unexpected calamity which has darkened the happy circle of our beloved Sovereign's home, and thrown a shadow over the light of Christmas hearths alike in the stately and the lowly "homes of England."

It seems as it were but a few short months since we saw the very manly and noble form of him who is departed, standing at the right hand of the Royal Presence, in the rich summer of life, surrounded by a pleasant band of children—or heard his voice in well-chosen, happily turned, if not eloquent, words, opening the proceedings of some gathering of educated minds for the advancement of the Arts and Sciences, or possibly with loftier aim, for the spread of education amongst the masses, to elevate the tone or ameliorate the condition of his fellow-men. Royalty has never given to the cultivated intellect of our country one so choicely adapted to preside over its councils—and it may be long, indeed, before its gatherings will be so gracefully honoured by the leadership of one so near the throne. And long will the memory of his calm and stately presence live in the minds of Englishmen, associated, possibly, with thoughts like these suggested by the portrait of one as prematurely lost :

"Yes; such as these the well-known lineaments—
Such the capacious front,
The comprehensive eye—
The open brow serene.
Such was the gentle countenance which bore
Of generous feeling, and of golden truth;
Sure Nature's sterling impress—never there
Unruly passion left
Its ominous marks infixed;
Nor the worst dye of evil habit set
An inward stain engrained.
Such were the lips whose genial playfulness
Enlivened peaceful hours of private life—
Whose gracious voice held thousands open-eared,
As from the heart it flowed, a living stream
Of Christian wisdom, pure and undefiled!"—*Southey.*

The enterprise and intellect of our country, now engaged in the stupendous task of preparing for the forthcoming exposition of the Science, the Art, and the Industry of the world, have to mourn the loss of the zealous leader of their splendid adventure ; and through every educated Association in the land will thrill the same genuine sorrow for the untimely passing away of Albert of Saxe-Gotha.

It would be as idle as impertinent for me to attempt even a sketchy outline of the progress of Science and of Art during the past year. As I already hinted, I may but glance at the relation of my outside world to such themes. The position occupied by the professors of Scientific knowledge in relation to the cognate worlds of Thought, to social, theological, or ethical philosophy, is all-important in its bearing on their ultimate usefulness to mankind.

It may be well to notice the most prominent aspect of this relation during the past twelve months.

A very old controversy—never really closed—has been forced into unwonted vitality and bitterness, chiefly by the interest attached to the peculiar position of certain of the combatants, and the deep-seated jealousy of large masses of excellent people towards scientific research, has received a most powerful stimulant. It has been assumed by thousands, that in some way or another the labours and the results of scientific investigations are hostile to the truths of revelation.

The uneasiness has been chronic. From the labors of the great Florentine in deciphering the story of the midnight heavens to the latest explorations in the crust of this aged world—from the demonstration of the diurnal motion, to the finding of the flint implements in the Picardy gravel beds, we have the same jealous distrust—generally honest—too often querulous and unreasonable—always most offensively exhibited by minds from habit and capacity the least suited for the right understanding of matters of such surpassing magnitude.

Much of this is traceable to the nature of the enquiry. It is of the very essence of inductive science; the condition of all logical pursuit, that the investigation of every scientific problem must be conducted by a mind simply striving after truth—striving to discover what *is*, not what ought to be, or what it wishes to be, in order to support some preconceived theory or deep-seated prepossession. The philosophic mind of the highest order, bending itself to the task of investigating obscure phenomena, whether amongst heaven's stars or earth's crust, must, to a great extent, ignore all preconceived opinions, and exert its keenest powers to collect, verify and register facts. Whether these facts, when ascertained, may tend to support or to weaken opinions and ideas—dear as life itself, possibly—to the heart of the investigator, is a matter which should be absent from his thoughts, as a dangerous enemy to the rigid impartiality with which his labors ought to be conducted.

It is of surpassing importance to us all, that Truth in all its purity should be unfolded to us; it is therefore of as paramount importance that those to whom we look for the precious revelation, should pursue their enquiries with a perfectly free glance—and with a judicial impartiality—unstained by the secret desire to find evidence to support a forgone conclusion.

Now, this principle is at the root of all scientific investigation, and also underlies much of the distrust that attends it. If we know that one man has strong opinions in favour of the Mosaic Cosmogony, and another is decidedly committed against it, we know enough of human nature to suspect the deductions which each may draw from his researches into a subject that as yet has hardly taken its place among the exacter Sciences. If we can find one whom we know to have started on his enquiry determined to see and register every phenomenon —one whom we can trust as not wilfully closing his eyes to appearances at least as striking as others that he records, lest they should bear against some previous theory or dogma, this man will be honoured by the earnest attention of every sound mind, and his report trusted as, with whatever imperfections, containing the honest record of things as he saw them.

We all know of the means pursued to get up evidence in support of particular theories. The history of Parliamentary "Blue Books" illustrates the practice. We have heard too often how such things are managed. A committee sits to take evidence on some subject of projected reform—sanitary, social or financial. It is true that all are invited to bear testimony, but practically the getting up of evidence is in the hands of a few, and those few almost always the persons most thoroughly committed to some particular specific for the evil sought to be remedied. We hear of cases where the determined theorist comes to enquire of men as to their knowledge of facts or conclusions from observation or experience. The witness whose opinions favored that of the applicant is carried off to testify; he who ventured on the expression of a hostile conclusion is dismissed with an "Ah! that is not the kind of testimony we are in search of!"

Now, this is morally dishonest in the highest degree; but it is unfortunately too true, and the result is, the slight esteem in which the "Blue Book" philosophy is held by the world.

The true worshipper of truth rises naturally into a purer atmosphere. For our guidance through the past, for our hope and trust in the present and the future, we have illustrious labourers, who breathe a clearer ether than that inhaled by the great mass of noisy and mischievous theorists. The surest test of the true investigator is the absence of all bigoted adherence to theory—the readiness to surrender an opinion as against an admitted fact. All educated men—foreigners, possibly, even in a higher degree than Englishmen—reverence the name of Newton, none more so than those who turn with disgust from the panegyric which, in its blasphemous bombast, is so unworthy of its great subject. A recent criticism on his life and works gives us an anecdote (new at least to me), tending still higher to elevate him in our esteem.

"It was the noblest of his noble qualities that he rigidly and sternly bowed down his hypotheses to facts. When Bradley and others had observed a certain nutation of the earth, which they could not account for, and were thinking it destroyed entirely the Newtonian system, they were under the greatest difficulty how to break it to Sir Isaac, and proceeded to do so in the softest manner. What was his only answer? '*It may be so; there is no arguing against facts and experiments.*' The experimental and theoretical deflections of the moon differed only in the rates of 16 to 13, but this was enough to satisfy Newton that his principle did not admit of proof, and to induce him to lay aside his speculations; but the more accurate measurement of a degree effected by Picard, after an interval of many years, supplied the data which made the moon a true witness for the law of gravitation."

This is an equally beautiful and eloquent rebuke to the rash confidence of many of our blind guides. ever too ready to wrest, mistake, or ignore facts, that make against their darling hypotheses.

Amongst the most mischeivous tendencies of this, as well as of preceding ages, may be reckoned the extreme fondness for deducing a novel hypothesis, oftentimes directly opposed to some wide spread opinion—before the facts and phenomena have been thoroughly investigated. Ambition is eager to acquire laurels in some new field, to startle the world by some dazzling discovery. This is exemplified in every day experience by the sanguine acquirers of patent rights. Some small discovery, mechanical or otherwise is made, and the excited owner rushes to register his invention, and specifies its ability to produce new and startling results long sought for, never till now attained.

Too often the waxen wings on which the discovery is launched, melt away before the sun-light of experience or practical application.

I once heard the great geologist whose portrait adorns our walls, asked for his opinion as to certain appearances noticed by him. The simple force of his reply is worthy of note:—"I have been too busy for the past few years in searching for facts to form any theory." It might be well for many who pursue the like studies to imitate such wise reticence.

Let *facts* be sought after with keenest industry, let phenomena be noted, observations registered, calculations verified, notes compared. Let truth and truth alone be sought after, and let theories for a while be left to themselves. Each scientific explorer has to remember what is the essential condition of his pursuit. It is not to prove or to disprove any scheme of cosmogony—not to aid or to falsify revelation, but simply to seek for facts.

Compared with what remains totally unexplored, the limits which discovery has mapped out for our information are singularly contracted. The pen of Brewster has pointed out with great felicity the little that has been done, compared with the vast wonders yet veiled in the unvisited realms of discovery.

"The dry land upon our globe occupies only one-fourth of its superficies. How much of this fourth part have geologists been able to examine, and how small seems to be the area of stratification that has been explored? We venture to say, not one fiftieth part of the whole, and yet upon the results of so partial a survey there has been founded a startling generalization. * * The astronomers of the present day have penetrated far into the celestial depths, compared with those of the preceding age, descrying in the remotest space glorious creations, and establishing mighty laws. Like them may not geologists descend deeper into the abyss beneath, and discover in caverns yet unexplored the upheaved cemeteries of primordial times. The earth has yet to surrender its stronghold of gigantic secrets, and startling revelations are yet to be read on sepulchres of stone. It is not from that distant bourne where the last ray of starlight trembles on the telescopic eye, that man is to receive the great secret of the world's birth, or of his future destiny. It is from the deep vaults to which primeval life has been consigned that the history of the dawn of life is to be composed.

Geologists have read that chronology backwards, and are deciphering downward its pale and perishing alphabet. They have reached the embryos of vegetable existence, the probable terminus of the formation that has buried them. But who can tell what sleeps beyond? The mortal coils of beings more lovely, more pure, more divine than man, may yet read to us the unexpected lesson, that we have not been the first and may not be the last of the intellectual race.*"

A noble passage—as profound as it is eloquent! and yet the man who could thus characterize "startling generalization" falls into the same original sin of science. On the most slender grounds, as is well known, he embraced as a certainty, the possibility of the doctrine of "more worlds than one," and stamped the theory of the Planets and Asteroids being inhabited, as "the creed of the Philosopher and the hope of the Christian." His coarse attack on Whewell for daring to doubt this, in the "Plurality of Worlds," is too well known as a melancholy example of the inveterate habit of theorizing. Those who feel pleasure in seeing such an onslaught well met and repelled, read with instructed satisfaction the temperate but irresistible answer of the accomplished Master of Trinity.

A very large class of minds shrink with undisguised dislike from every inquiry which may possibly clash with any firmly established doctrine or theory. This conservative feeling has done good service in its day, and must not be lightly despised, but it must not be pushed beyond legitimate bounds. The Brahmin dashed the microscope to the ground, and cursed the art which shewed him myriads of objects floating in a glass of his daily drink from his sacred Ganges. Our Newton was branded as an Arian heretic for questioning the genuineness of the celebrated half verse in St. John's epistle. Few scholars will now-a-days do battle for it. We can hardly afford to imitate the judicial blindness of the Brahmin. We must be careful, even in defence of things we consider sacred, not to imitate the assailants of Newton.

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* More Worlds than One.

Everything, whatever may be its position in the veneration of the world, must in an age like this, stand the test of criticism. Its claims, in our belief, must be prepared for strict examination.

No faithful heart need fear the result—the dross will shrivel and wither in the fiery test—the pure gold will remain fairer than ever.

Hardly a year has elapsed since the now famous "Essays and Reviews," startled the sober minded world from its propriety A hundred so called answers have fluttered in hot haste from the press, a wild storm of rebuke has come from many throats—none however so loud or so virulent as those whose owners had never read a line of the work in question. To the infinite profit of publisher and fame of authors, it has taken its place very high up in the "Index Expurgatorius." In common with many others who have taken the trouble to read the book, I think its publication will ultimately effect a large amount of good, and will succeed in pouring a flood of light on some of the questions suggested. Most of the views that have caused alarm, possess no novelty whatsoever, but as one of their most sensible opponents has happily said, "what is put forward as new lights is simply ancient darkness." Some of the as yet half investigated phenomena of Geology, are made to speak with far too certain a voice, as to the past history both of man, and the earth on which he stands, and onslaughts are made on popular opinions, on premises as yet, I humbly conceive, wholly insufficient to support the writers conclusions. But the real mischief which the book may possibly work, lies in the very unfair, though not unexpected use which the openly avowed opponents of Revelation have hastened to make of its too rash admissions and concessions.

The only legitimate object of introducing the notice of this work into these remarks lies in the intimate relation, which, in the world's judgment, exists between its conclusions and the labours of material science. A certain looseness of expression adopted by the Essayists has contributed largely to the formation of this opinion.

For one example out of many I may notice the loose language used in discussing the Mosaic Cosmogony, as possibly, "the speculations of a Hebrew Newton or Descartes." This expression, besides jarring unpleasantly on most ears, will not bear any critical examination, and is in fact as unjust to the Hebrew Lawgiver as to the modern astronomer.

A large portion of thinkers will possibly consider that the book, amongst other points of value, is sound in its enunciations of the true canons of interpretation and critical analysis, applicable alike to sacred and secular composition. The most utterly unsatisfactory part of the book, and possibly that part to which scientific men will feel least indulgent, is the laboured article against miracles, where the writer speaks of all cultivated minds recognizing "the impossibility of any modification whatsoever in the existing conditions of material agents, unless through the invariable operation of a series of eternally impressed cousequences, following in some necessary chain of orderly connections, however imperfectly known to us;" and again, "The simple but grand truth of the law of Conservation and the stability of the heavenly motions, now well understood by all sound cosmical philosophers, is but the type of the universal, self-sustaining, and self-evolving powers which pervade all nature."

This is the key note of much to the same effect, and to my unspeculative mind the whole seems coloured by an inveterately hasty adoption of conclusions as being indisputable and universal, whilst still resting on very loosely established premises. The assumed "immutability of the laws of nature," is the ground work, and an exaggerated exultation of such "laws," and a practical depreciation of the power and will of the Lawgiver, the result. The writer last quoted has already passed from shadows to realities, and sees now mayhap with clearer vision, having long, like ourselves, "seen as through a glass darkly."

Most of my hearers have read the very nobly expressed article on the "*Immutability of Nature,*" in a late periodical. The phrase itself is denounced as "not only involving a violation of the first laws of accurate inductive reasoning, but charged with most perilous conclusions to Christion Faith unless it be carefully modified." Again, "Incautious language is the dry-rot of the world. The historians and philosophers of physical science remind us in every page, of the power of words, mere words—warn us, how they necessarily contain the sporules of mighty principles, how they give to those principles wings to fly, and filaments to root them in the earth, and a power of propagation able to cover the whole field of truth with the most noxious weeds, so that when once their hold is taken it is almost hopeless to eradicate them," and very appositely is the great name of Newton made to repeat how God acts in what is called Nature. "*Secundum leges accuratas ut naturæ totius fundamentum et causa, constanter coöperans, nisi ubi aliter agere bonum est,*" according to uniform laws except when it be good for Him to act otherwise.

As I have already remarked a flood of light is being turned upon many of the subjects thus peculiarly brought before the public.

The full discussion thus elicited will, amongst other good effects, serve to dissipate an uneasy feeling which prevailed extensively, of the vast superiority of German critical analysis and explorations of the text of the sacred writings.

It seemed almost conceded that no names could be found to weigh against the established reputations of the Bauers, De Wettes, and Strausses. General readers may feel somewhat reassured by the mention of such names as Hengstenberg and Max Müller, and others brought prominently forward of late, as occupying very different, although equally honourable places among German philologists.

Science has not been false to her great mission on earth, and has advanced torch in hand to explore and light up many of the dark caverns of which the black mouths alone have been exhibited to us, by those, who seem rather to delight in pointing out darkness than in striving to explore it. Patient research has journeyed toilsomely through lonely and savage lands to trace out perishing characters of the elder days, on Idumean tomb, Egyptian obelisk, or Assyrian trophy. It has called to its aid a wondrous handmaiden, the photographic art, to copy the ancient letters as in a mirror, and patiently has it unravelled the strange alphabet, hieroglyphic, or Cufic or Cuneiform, till the world was shewn the cotemporaneous record of a Sesostris or a Nebuchadnezzar.

The Bampton Lecturer for 1859, Mr. George Rawlinson, has given us a noble contribution to the Christian Evidences, wholly drawn from the sources of profane history, and the recent decipherings of Egyptian, Babylonian, Persian, and Assyrian records. I cannot refrain from giving two brief examples of these interesting testimonies, if only ta shew how truly worthy of perusal is such a work in such an age. Those who wished to impugn the book of Daniel, are wont to point out that while the prophet makes Belshazzar the last King of Babylon and slain at its capture, the historian Berosus gives Nabonadius as the last native king, that he was absent from the city at its capture and was not slain but taken prisoner by Cyrus. This was embarrassing. But Sir Henry Rawlinson, the gifted brother of the lecturer, found an inscription in 1854, at Mugheir, the ancient, "Ur of the Chaldees," stating that Nabonadius the last King, during the later years of his reign, associated with him in the throne his son "Bil-shar-uzur," and allowed him the royal title. There can be little doubt, he adds, that it was this prince who conducted the defence of Babylon and was there slain.

Again, we all know the strange wild story of Nebuchadnezzar's madness as told in Daniel. Among the records of this great King's reign a most remarkable inscription, known as the "Standard Inscription," has been found which offers grave matter to the thoughtful. It is written in the first person by the King himself, and tells us that during some considerable time—four years apparently—all his great works were at a stand, he did not build high places, he did not lay up treasures, he did not sing the praises of his Lord, Merodach, he did not offer him sacrifices, he did not keep up the works of irrigation. No explanation is given or cause assigned. But I must not trespass too much on your indulgence in pursuing this, to me at least, singularly attractive theme.

The marvels of Science will always possess a fascination and attraction for a large class of youthful minds. The blue depths of the midnight heavens will attract some, the chronicles of earth's life, cut deeply in her rugged pages will call others to read their story. Modern skill and appliances can unfold marvels from the common sights of nature. "If the stars," says Emerson, "had looked out upon the night but once in a thousand years, how the legend would have gone from father to son, of the City of God thus revealed unto man."

If the vast field of heaven were in like manner unfolded to man's observation as the astronomer has it before him in telescopic vision, the moon mapped out into mountain chasm and arid valley ; the planets glorified in size and splendour, girt with luminous bands and "satellites burning in a lucid ring," as glowing a tale of enchantment could be framed for the wonder of the world.

And startling are the hints of things probable, though as yet unproved, occasionally suggested to us. Photography suggests that the image of every scene on which the eye has rested, remains painted on the retina, a vast picture gallery for memory to unlock and gaze on at pleasure. It is hinted to us that nothing once received by the ear is ever lost, but is stamped upon the brain to be recalled or used at will, or to be brought back at the touch of some secret spring. Or, more startling still, that every sound, everything spoken, never dies, but goes forth in a widening circle among the waves of space ; that the great cry that went up in the Egyptian midnight, that the lamentations of Ramah may yet be wailing among distant stars, giving a terrible significance to the old warning that man has to account for every idle word at a future reckoning.

All these marvels, facts and fancies, must attract the active and imaginative minds of our day. It is a matter of vital moment that those who are laudably jealous for the cause of revealed religion, should not needlessly place themselves in opposition to the fullest and freest enquiry, and the most impartial search for facts and phenomena on the part of science.

"Every good gift and every perfect gift cometh down from Him with whom is no variableness or shadow of turning." He who richly endowed the mind of a Newton to elucidate his laws, of a Butler to deduce profound analogies from His courses in nature, has not, we may trust Him, given choice gifts of perception and demonstration to our Murchisons, Lyells, Millers or Logans to dishonour his works or to falsify aught that he has revealed to his creatures. Let us have faith in our great truths, and not do them or ourselves the foolish injustice of treating them as dependant on the truth or falsehood of any received theory of Astronomy, Cosmogony or Chronology.

No record of æons and æons of ages brought up from the deep heart of earth ; no trace of man's work, or of his bones in ancient gravel-bed or protozoic formation, will ever induce the world to surrender its heritage of glorious truths under the New Dispensation. The most sceptical has failed to give any plausible origin, apart from direct inspiration, for the wonderous system that rose pure, and white, and lucid,—a veritable City of God, shining in stainless beauty and majesty, like His Spirit over the dark waters of an effete and perishing Paganism, of blank Atheism, or pantheistic extravagance. Men will not surrender the "Father's house of many mansions," for Stygian rivers and Elysian meadows, or Islands of the Blessed, that shine so drearily in Horatian song or Platonic vision.

Even those who cling most closely to their favorite "Immutability of Nature," and speak doubtingly of miracle and portent, still cherish in their heart the great home-truths of Revelation. These great beacon lights of Time and Eternity still shine, and ever will shine, over the waste of speculative doubt and hinted impossibility, even as when the multitude of the heavenly host, the long drawn lines of Seraphim and Archangel, effulgent in the white light of Paradise, were swallowed up in the black depths of night, and the quiet stars unmoved in their stately beauty, looked down on the dazzled eyes of the believing Shepherds.

A very large number of persons, members and non-members of Scientific bodies, take an increasing interest in the result of Scientific research, and would gladly become familiar with the alphabet of the system. They are generally deterred by the new language proposed to them as a condition of the desired knowledge. Ignorance of Greek, a very common disease with the masses, is a terrible difficulty in the very threshold; and without the persevering student, who knows nothing of the powers of that wondrously plastic tongue, has to fatigue his memory with thousands of (to him) most unmeaning and formidable compound terms. The variation of a vowel, the mistake of a dipthong, being occasionally so fatal to accuracy as to send the poor groper among the Infusoria into the startling company of Plesiosauria or Pachyderms. The Greek of Sophocles or Æschylus has even to undergo some comic violence in its adaptation to the anatomy and economical habits of the animal and vegetable kingdoms. Scientific nomenclature is, doubtless, a necessity, and without it there could be little communion of labour or thought among the learned of many lands. Still, one may be permitted to regret, that to the increasing millions who speak that pleasant English tongue, "whose sound" (as has been grandly said) "has gone into all lands, and whose words to the ends of the earth," we cannot as yet teach the marvels of science, the wondrous story of the mutations of their own earth, and unfold its mineral and floral wealth, as readily as we teach them the history of man or the elements of morals or religion.

We are sadly in want of truly popular explanations of scientific research. The mere English scholar turns up a so-called *popular* treatise to learn something of an animal, he is enlightened by finding that it is perhaps a graminivorous pachyderm, or some fossilized relic that is "crustacean, semi-calcarious, striated, cordiform, and is never found in palæozoic formations." A pleasant writer says, "Even the 'hand books' and 'outlines' intended for general readers and docile beginners, abound in words of such puzzling obscurity (not to mention the abstruse speculations frequently implied in their very mention) that one would think the English public was made up of pundits, and been reared in the nursery in the circle of the Sciences." What, in the name of Linnæus, he will ask, can be meant by the sub-Kingdom 'Cœlenterata?' His knowledge of Greek, be it ever so extensive, will not carry him far in this fog. It is all very well to talk of a sub-Kingdom of 'hollow-gutted animals,' but what *are* they?" And again speaking of a most meritorious book by an excellent author, 'If in the next edition he would only bear in mind that even students are anything but familiar with many of the technical terms so profusely scattered unexplained through his pages, that even students are not all Grecians, and that a knowledge of Greek very often lends little or no assistance to one who does not already know the meaning of the term as applied in the special case, he will greatly improve his book. We are perfectly aware of the necessity of technical torms, Science is impossible without a strict nomenclature; but we are also aware that if many writers are misunderstood because they do not attend sufficiently to those exigencies of technical expression, many also are thrown aside unread, because they will say nothing in their mother tongue.

"Every one knows the dreadful kind of mathematical writer or speaker, who "rushes into the differential calculus on the slightest provocation." And we could name more than one biologist who rushes into Greek, and spurns the plainer and more expressive English, as if his scientific reputation depended on his not saying anything in common language."

The past year has witnessed the usual gatherings of the philosophic and scientific intellects of the age. If not marked by any special originality, they have developed more clearly than ever the strong practical tendency of the age, to subordinate all the energies and appliances of Science, invention, and association, to the correcting of social evils and the elevation and purification of man. The British Association has heard from their Fairbairn a grand epitome of the progress of material science. The Dublin Social Congress has elicited, with much crude speculation, a large amount of practical suggestions for future operations. Death has done his usual work. Besides the Royal Prince, whose departure we have already noticed, he has taken away another of the thoughtful Teutonic blood. Baron Bunsen, in the full exercise of his splendid labours, has passed away, declaring with his last breath his profound belief in that Revelation he has so often been accused of assailing. Sir Francis Palgrave, whose profound antiquarian knowledge will long serve to lighten the labours of the student of the Past, has been taken from us. Elizabeth Barrett Browning has passed away from a wide circle of admirers; and thousands to whom the name of Italy brings back grand memories of ancient dominion, or gentler thoughts of preeminence in those Arts that delight the eye and elevate the soul, will hardly forget that the year just past has witnessed the death of Camille Cavour.

"It is a pleasant thought," says Charles Kingsley, "to feel surer, day by day, that one is not needed—that science moves forward swift and sure under a higher guidance than our own—that the sacred torch-race never can stand still, that He has taken the lamp out of old and failing hands, only to put it into young and brave ones who will not falter till they reach the goal."

Yet a few words more and I have done. The war-cloud that has risen so threateningly in our southern horizon has lately, in some degree "turned out a silver lining on the night," and the mild arts of peace may perhaps still be allowed to flourish, unchilled by the breath of War. The rising cloud may somewhat dim the cheering sunshine of our prosperity; but its shadow will fall upon a land alive with citizen-soldiers prepared to defend its soil to the last; satisfied with its political position, unprepared for changes in its allegiance. We have lived long enough to refuse to turn from the chaste and gracious form of our Constitutional Liberty to the worship of the base counterfeit which has been raised on this Continent in the stead of the veritable Goddess.

Know ye not then the Harlot? Know ye not
The shameless forehead, the obdurate eye,
  The meretricious mien,
The loose, unmodest garb with slaughter foul?
Your Fathers knew her! When the nations round
Received her maddening spell,
And called her—Liberty—
And in that name proclaim'd
A jubilee for Guilt!

Listen to some memorable words written sixty years ago:—

"Thanks to our sullen resistance to innovation—thanks to the cold sluggishness of our national character, we still have the stamp of our forefathers—we have not lost the generosity and dignity of thinking of the 14th century, nor as yet have we been subtlelized ourselves into savages—we are not the converts of Rousseau—we are not the disciples of Voltaire—Helvetius has made no progress amongst us—atheists are not our preachers—madmen are not our lawgivers—we know that we have made no discoveries, and we think that no discoveries are to be made in morality—not many in the great principles of government nor in the ideas of liberty, which were understood long before we were born, as well as they will be after the grave has heaped the mould upon our presumption and the silent tomb imposed its law on our pert loquacity.

"In England we have not yet been completely embowelled of our natural entrails—we still feel within us and we cherish and cultivate those inbred sentiments which are the faithful guardians, the acting monitors of our duty, the true supporters of all liberal and manly morals. We have not yet been drawn and trussed in order that we may be filled like stuffed birds in a museum with chaff and rags, and paltry, blurred shreds of paper about the rights of man. We preserve the whole of our feelings still native and entire, unsophisticated by pedantry and infidelity. We have real hearts of flesh and blood beating in our bosoms. We fear God, we look up with honor to Kings, with affection to Parliaments, with duty to magistrates, with reverence to priests. Why? Because when such ideas are brought before our eyes, it is natural to be affected, because all other feelings are false and spurious and tend to corrupt our minds, to vitiate our primary morals, to render us unfit for rational liberty, and by teaching us a servile, licentious, and abandoned insolence to be our low sport for a few holidays, to make us perfectly fit for, and justly deserving of, slavery throughout the whole course of our lives.''

The ring of the true metal sounds through these almost prophetic words. I need hardly name the writer as Edmund Burke. We can have no fear for the result of any contest into which the lust of conquest or outrages in our national honor may plunge us. "An unjust war is the greatest of iniquities—a just and defensive war the last and greatest appeal to the God of truth."

And now let these very discursive remarks draw to a close, not in mine own weak words, but in the lofty strains of one of our truest Poets, when he told his countrymen, threatenened with invasion :—

It is not to be thought of—that the flood
Of British freedom, which to the open sea
Of the world's praise, from dark antiquity
Hath flowed with pomp of waters unwithstood—
Roused though it be full often to a mood
Which spurns the check of salutary hands—
That this most famous stream in bogs and sands
Should perish—and to evil and to good
Be lost for ever.—In our halls is hung
Armoury of the invincible knights of old;
We must be free or die, who speak the tongue
That Shakspeare spake, the faith and morals hold
That Milton held. In everything we are sprung
From Earth's first blood, have titles manifold!

# NOTES ON THE CHOLERA SEASONS OF 1832 AND 1834.

BY REV. C. DADE, M.A.

The following paper contains the results of personal observations taken during the Cholera Seasons of 1832 and 1834, in the City of Toronto. The subject does not involve medical considerations, but is considered as bearing upon the connection between atmospheric conditions and æsthetic phenomena. During the period above alluded to I kept a careful record of the weather and its prevailing features, the observations being mainly thermometric.

The year 1832 must ever be considered as a most memorable one in the annals of Canada, and it was fraught with lamentation, and mourning, and woe. We were visited with domestic discord and foreign invasion. In both, blood was freely poured forth; but what comparison is there between the victims of the sword and of that fell destroyer, which spared neither age nor sex, and against whose desolating attacks vain was the help of man. The appearance of the cholera on the American continent was an event which inspired not only universal dread but almost universal curiosity. We had traced it in its course from east to west, resembling in this all other pestilences of modern and ancient times, and there seemed but little doubt that in its onward career it would reach the shores of the far western world. There seemed to be a fairer opportunity of determining the nature and origin of the disease than at any previous period, and thus with varied feelings of awe and expectation men awaited the arrival of the terrible visitant. Rumours and surmises were soon converted into certainty, for on June 8th, 1832, the first case of cholera occurred in Quebec. To use the expressive language of the poet,

> "Like a thunder peal,
> One morn a rumour turned the city pale.
> And staring on each other, fearful men
> Uttered with faltering voice, one word—the Plague!"

The first subjects were emigrants, and were exposed to no other source of infection than the filthy state of their lodgings in that focus of abominations, the Lower Town of Quebec, stated by the board of Health to be a "low, dirty, ill-ventilated part of the City, crowded with emigrants of the lowest description." The pestilence having thus got foothold, spread rapidly, and reached York, the capital of Upper Canada, June 19th. This place at the time might be considered as a spot peculiarly set apart for the abode of the destroyer. All the deadly elements which engender and foster disease and death were then in active operation. The Quarterly Reviewer of the day pronounced the "three stinking cities of Europe to have been, Lisbon, Edinburgh and Geneva," and if those of the New World had been classed in the same unsavoury category, "Little York," as it was then called, would no doubt have occupied a prominent place. The genius of filth, if such there be, reigned predominant both in public and private. Crowded and loathsome hovels, cellars with putrid and stagnant water, dunghills with animal and vegetable garbage reeking in the scorching rays of the summer's sun, these deadly agents everywhere spread their contaminating influence. The curse of strong drink aggravated the horrors of the devouring pestilence, and the filthy and intemperate were its most numerous and earliest victims; but having once taken hold, it gradually seized upon individuals of all classes, till at length neither age, constitution, habit, or condition, seemed to furnish any exemption. The popular opinion which prevailed of its being contagious not a little contributed to the general consternation. It would be foreign* to our purpose to enter into this controversy, which has many great names on both sides, for who shall decide when doctors disagree. One thing however was certain, that while contagionists and non-contagionists were battling the question, the disease, whether infectious, contagious, or a compound of both or neither, spread with unabated violence, and well nigh baffled all the skill of man. It will not be out of the way to mention an apparent exception. The 79th Highlanders were then quartered in the garrison, and their surgeon, Dr. Short, had been so successful in the preventive measures adopted, that in August the Board of Health published the following statement: "To satisfy the most sceptical on this subject they consider the importance of it will fully excuse them for subjoining the information so kindly permitted by Dr. Short, Surgeon of the 79th Regiment, to disclose for our guidance the course pursued in the York garrison, and which has been attended with such happy results, not one case of cholera having therein occurred." Here follows a detailed account from the Dr. of the method adopted, which it is unnecessary to insert here, and though the precautions, &c., used under a military régime, could not be of universal application, yet they plainly prove how efficacious secondary agents may be in alleviating the direst visitations. Meanwhile the Town of York presented a most melancholy spectacle. Business was well nigh suspended, the prevailing panic keeping away all visitors from the country; and one might almost say, that the stillness of death reigned in its deserted streets, traversed continually by the cholera carts conveying the dead to the grave and the dying to the hospital.

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* An able communication, signed Q. H. Y., was addressed to the *Quebec Mercury*, which seems to have been the production of Dr. Henry, author of that amusing book, "Recollections of a Staff Surgeon." The Dr.'s experience of the disease, as it occurred in the East Indies. was extensive. He says, "The great secret in treating the disease is to get at it in time. I was for nine months in charge of 1500 men, natives, in 1819. My mode of management was this. Each Serang (head of a gang) was provided with a bottle of brandy and laudanum, mixed in the proper proportions, and a measure exactly a dose for an adult; his instructions were to give the patient a dose and run with all speed for me; if he came in time I gave him a rupee, if he neglected his duty he was treated to a sound whacking with a bamboo, and thus with two strong motives, the hope of reward and the fear of punishment,I was speedily apprised of the danger, and thus, though many were attacked, I did not lose a single patient." Again, "Is cholera contagious? The *Quarterly Review* says it is, I say it is not;" and he proceeds to give a number of "unquestionable facts" in proof of his assertion.

It was impossible at the time, and still more so now, to find anything like an accurate estimate of the number of cholera victims, and the relative proportion of the cured and the dead. The reports of the Board of Health published at the time, cannot be considered more than an approximation. It was then a subject of complaint that several medical practitioners furnished either imperfect details or none at all. Numbers were buried by their friends without any record being kept, and many were the victims of quackery and out of the pale of medical practice, so that the only accessible reports were necessarily extremely defective, falling probably nearly half below the truth as regards the number of cases, and much more as to the number of deaths. The Board sat daily from 3 to 5 p. m., and left nothing undone within their power which could either arrest the progress of the pestilence or mitigate its rigour. The following are specimens of their reports:—

"YORK, Aug. 3rd, 1832.

| | |
|---|---|
| Cases remaining in Hospital | 32 |
| New cases | 14 |
| Cured | 3 |
| Died | 3 |
| Remaining | 40 |

August 7th, 1832.

| | |
|---|---|
| Cases remaining | 40 |
| New cases | 19 |
| Cured | 8 |
| Died | 11 |

Total number of cases reported since the commencement, 239; deaths, 105. No report from four medical practitioners.

In Montreal, where the ravages of the pestilence were more terrific according to its population than in any other part of the globe, the number of cases, in August, was 284, and burials 149.

Total number of cases each week during the cholera months of June, July, and August:—

| | | | |
|---|---|---|---|
| June 2 | 4833 | July 21 | 2787 |
| “ 9 | 10599 | “ 28 | 1353 |
| “ 16 | 2316 | Aug. 4 | 94 |
| “ 23 | 2478 | “ 11 | 3931 |
| “ 30 | 1654 | “ 18 | 909 |
| July 7 | 2407 | “ 25 | 540 |
| “ 14 | 3126 | | |

From this it is evident that the statistics of the cholera of 1832 in York are more a subject of conjecture than otherwise. It was said at the time, and it was not going beyond the mark, that the population of the town, then consisting of about 6000 persons, was at least decimated. In the City of Montreal alone the interments from June 10th to Sept. 1st were 2820, and according to the estimate of the Chief Agent at Quebec, no less than 2350 of the emigrants of 1832 fell victims to the disease. The emigration of that year was unprecedently great:—

| | |
|---|---|
| 1829, | 15,945 |
| 1830, | 28,000 |
| 1831, | 50,254 |
| 1832, | 51,746 |

The crowded state of steamboats and other vessels, the peculiarly exposed state of the poorer emigrants to the varying temperature, scorching sun, and chilling rain, together with the debilitating effects in many cases of a long sea voyage, all these causes told with fatal effect, and aggravated the malignity of the appalling malady.

We now proceed to enquire whether there were any peculiar features in the seasons of these two years of plague, viz.: 1832 and 1834, calculated to increase or diminish its virulence. It has been said that cholera is more independent of climatic influences than any other disease whatever. The ravages of the yellow fever, for instance, are confined to a particular region, and if the traveller escapes infection and reaches a certain height he is safe. Thus it has never visited the City of Mexico, though the coast and neighborhood is its chosen abode, but the cholera devastated both alike. Still no one can deny that the effects of this as well as all other diseases must be modified by the varying circumstances of climate and locality. The latter was abundantly proved by undoubted facts, and the former is equally certain. All those deadly agents which, if they do not actually engender, foster disease, are mitigated or heightened by any deviation from the normal state and character of the season. The filthy elements in which Little York, in common with Montreal and Quebec, abounded, were made more active agents of disease and death by scorching suns, heavy rains, great evaporation, and sudden and violent fluctuations of temperature. Therefore the various atmospheric phenomena which precede and accompany the visitation of a pestilence are surely deserving of notice. "Coming events cast their shadows before," both in the natural as well as the moral world, and he must be a shallow observer who fails to note their indications.

In the bygone ages of ignorance and superstition any terrible visitations were supposed to be heralded by supernatural appearances in the heavens above and in the earth beneath. Such ideas are now exploded, "They live no longer in the light of reason." But though the pestilence walketh in darkness it gives sufficient tokens of its approach, and without entering more fully into this part of the subject it has been said, that whenever it has arrived deviations from the usual conditions of the season in temperature and other features marked its advent and progress To enquire whether this was the case in Canada is the object of the following remarks, founded upon indisputable facts of which the infant science of meteorology stands so much in need, and the collection of which therefore, humble as the task may be, is surely advisable.

We will commence with December, 1831, a most remarkable month, and as I can testify from personal observation, unequalled for thirty-two years at least. The mean temperature of this month at 8 a. m.,

=12·6; nor did this low temperature arise from great extremes, but rather from a continuous state of uniform cold, the mercury never rising above the freezing point. With such weather on this side of the Atlantic the cholera was devastating the North of England, under the circumstances of mild, open weather and humid atmosphere.

| Days. | 8 A. M. | 5 P. M. | 9 A. M. | Days. | 8 A. M. | 5 P. M. | 9 A. M. | At the Royal Phil. Society, London. |
|---|---|---|---|---|---|---|---|---|
| 1 | 14 | 14 | 48 | 17 | 12 | 2 | 52 | ...... |
| 2 | 6 | 14 | 50 | 18 | 5 | .... | 53 | ...... |
| 3 | 12 | 20 | 51 | 19 | 17 | 22 | 50 | ...... |
| 4 | 12 | .... | 50 | 20 | 17 | 23 | 51 | ...... |
| 5 | 5 | .... | 51 | 21 | 29 | 13 | 52 | ...... |
| 6 | 14 | 19 | 52 | 22 | —6 | 9 | 49 | ...... |
| 7 | 11 | 19 | 53 | 23 | 13 | 25 | 49 | ...... |
| 8 | 18 | 25 | 54 | 24 | 32 | 33 | 46 | ...... |
| 9 | 3 | 15 | 56 | 25 | 14 | 24 | 43 | ...... |
| 10 | 7 | 17 | 55 | 26 | 20 | 23 | 43 | ...... |
| 11 | 23 | 24 | 56 | 27 | 11 | 19 | 44 | ...... |
| 12 | 8 | 13 | 56 | 28 | 19 | 25 | 44 | ...... |
| 13 | 9 | 12 | 56 | 29 | 19 | 17 | 45 | ...... |
| 14 | —2 | 14 | 56 | 30 | 15 | 19 | 46 | ...... |
| 15 | 4 | 10 | 55 | 31 | 14 | 24 | 45 | ...... |
| 16 | 18 | 20 | 54 | | | | | ...... |

M. T. at 8 a.m., 12·6; Monthly range, 39; Rain, 0; Snow, 9; E. 6; W. 29; Daily range, max. 35. The column marked "9 A.M.," indicates the corresponding temperature in London, England.

| | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sep. |
|---|---|---|---|---|---|---|---|---|---|
| M. T. ....... | 19 | 16·7 | 28.0 | 38 | 48·7 | 62.7 | 67.1 | 6.38 | 55.7 |
| R. .......... | 51 | 65 | 53 | 43 | 35 | 29 | 29 | 29 | 32 |
| *r*. .......... | 37 | 30 | 35 | 25 | 16 | 23 | 20 | 19 | 21 |
| Mr. ......... | 15 | 14 | 10 | 8 | 4 | .... | 10 | 6 | .... |
| E. .......... | 10 | 11 | 11 | 12 | 18 | .... | 6 | 10 | 12 |
| S. W. ....... | 6 | 4 | 10 | 10 | 9 | .... | 15 | 15 | .... |
| Rain ....... | 2 | 3 | 2 | 8 | 8 | 8 | 12 | 9 | 10 |
| Snow ...... | 4 | 9 | 4 | 1 | 0 | 0 | 0 | 0 | 0 |
| Th. ......... | 0 | 0 | 1 | 0 | 0 | 1 | 4 | 2 | 2 |

In this table M. T. denotes the mean temperature at 8 a. m.; R. the range of the mercury for the month; *r*. diurnal ditto; between Ms. of 8 and 12. It may here be remarked that the monthly means alone would convey a very inadequate idea of a climate like that of Canada, subject to such great and sudden fluctuations, for the same result is produced by a series of uniform temperatures, or high extremes balancing one another. Therefore in considering the actual season of cholera, a reference will be made to other and minuter calculations. Meanwhile it will be sufficient to say of the earlier part of 1832, that the spring was remarkably cold, dry, and backward, and unfavorable to vegetation.

The month of June, in which the cholera commenced, exhibited no very remarkable anomalies, although there were sudden variations of temperature, as *e.g.* from 78° on the 17th to 57°, 53°, 57°, on the three following days. In July and August the ravages of the disease were the most severe.

The first nine days of July were hot, succeeded by five below the mean, with northerly winds and showers. The character of the month was cool and variable, rain fell on twelve days, and the diurnal range exceeded 20. In August the thermometer was once at 49° 84m., and once only above 80°. As to electric phenomena, there were few thunderstorms, and none of peculiar severity. So that upon a review of the season of 1832 we should say, that the spring was backward, the summer cool, and thermic anomalies, as the phrase goes, by no means uncommon.

In September the pestilence gradually abated, and by the end of the month disappeared, leaving behind it traces of its desolating career which were not likely to be forgotten. Many a valuable life was sacrificed, "there was truly a great cry in the land," of the widow and the orphan thrown destitute on the world. To instance one case out of thousands. In one family, by the death of two brothers and a brother-in-law, mechanics in good employment, seventeen children were left orphans entirely without the means of support. In Quebec alone there were supposed to be at least 1000 of these unfortunate, destitute objects. The sympathy, however, of the charitable was not wanting, and in York a liberal contribution was raised for the widows and orphans of cholera victims, and public and private benevolence was actively employed in alleviating the calamities which every where met the eye. So passed the year 1832, the most disastrous in the annals of Canada.

In 1833 there was a freedom from disease, and the Province began to recover from the blow which had paralyzed its energies. Trade revived, and the stream of emigration again set in upon our shores.

The Town of York was now transformed into the City of Toronto, and received the blessing of a Corporation of City Fathers, bent upon improvements and reform. New brooms sweep clean. Streets were cleansed, sewers dug, middens abolished, groggeries mitigated, and mire and mud superseded by plank and McAdam. Many a venerable nuisance was swept away, and the terror caused by the recent visitation gave rise to many wholesome and sanitary precautions. Though much remained to be done, much no doubt was done, though the disciples of the McClarty school were still too numerous to permit all the purifications necessary. We now come to the year 1834, which was marked by the second visitation of the dreadful pestilence. An inspection of the annexed tables will shew that this season was both remarkable in itself, and formed a strong contrast to the preceding year of plague. It will be well to give a brief sketch to illustrate the subject.

| 1834. | Jan. | Feb. | Mar. | April. | May. | June. | July. | Aug. | Sept. |
|---|---|---|---|---|---|---|---|---|---|
| M. T....... | 16.4 | 27.3 | 30.6 | .43 | 52.3 | 60.8 | 70.8 | 65.7 | 55.2 |
| R.......... | 43 | 40 | 42 | 45 | 53 | 36 | 25 | 37 | 49 |
| r.......... | 26 | 35 | 23 | 23 | 18 | 22 | 20 | 18 | 25 |
| N. W...... | 11 | 8 | 6 | 6 | 4 | 4 | 2 | 4 | 5 |
| E. ......... | 12 | 16 | 11 | 18 | 16 | 16 | 14 | 11 | 15 |
| W.......... | 8 | 4 | 14 | 6 | 11 | 10 | 15 | 16 | 10 |
| Rain........ | 3 | 4 | 5 | 12 | 9 | 12 | 12 | 9 | 11 |
| Snow...... | 6 | 3 | 5 | 2 | 1 | 0 | 0 | 0 | 0 |
| Thun....... | 0 | 1 | 1 | 1 | 4 | 1 | 8 | 6 | 1 |
| Plur. ....... | .. | .73 | 1.38 | 2.21 | 1.97 | 3.17 | 3.68 | 1.35 | 1.77 |

| 1832. | Bel. 0. | 0–10 | 10–20 | 20–32 | 32–40 | 40–50 | 50–60 | 60–70 | 70–80 | 80–90 |
|---|---|---|---|---|---|---|---|---|---|---|
| Janua'y. | 2 | 7 | 5 | 13 | 4 | .. | .. | .. | .. | .. |
| Feb.... | 3 | 6 | 9 | 10 | 1 | .. | .. | .. | .. | .. |
| March.. | 1 | 4 | 2 | 9 | 10 | 5 | .. | .. | .. | .. |
| April... | .. | .. | .. | 5 | 15 | 8 | 2 | .. | .. | .. |
| May ... | .. | .. | .. | .. | 2 | 18 | 10 | 1 | .. | .. |
| June ... | .. | .. | .. | .. | .. | .. | 10 | 18 | 2 | .. |
| July ... | .. | .. | .. | .. | .. | .. | 2 | 19 | 10 | .. |
| August. | .. | .. | .. | .. | .. | 1 | 11 | 16 | 3 | .. |
| Sept .... | .. | .. | .. | .. | .. | 6 | 18 | 6 | .. | .. |
| Total .. | 6 | 17 | 16 | 37 | 32 | 38 | 53 | 60 | 15 | .. |

| 1834. | Bel. 0. | 0–10 | 10–20 | 20–32 | 32–40 | 40–50 | 50–60 | 60–70 | 70–80 | 80–90 |
|---|---|---|---|---|---|---|---|---|---|---|
| Janua'y. | 1 | 6 | 16 | 7 | 1 | .. | .. | .. | .. | .. |
| Feb.... | .. | 1 | 6 | 12 | 8 | 1 | .. | .. | .. | .. |
| March.. | .. | 1 | 4 | 13 | 9 | 4 | .. | .. | .. | .. |
| April .. | .. | .. | .. | 5 | 6 | 13 | 6 | .. | .. | .. |
| May ... | .. | .. | .. | 1 | 4 | 10 | 6 | 9 | 1 | .. |
| June ... | .. | .. | .. | .. | .. | .. | 14 | 16 | .. | .. |
| July.... | .. | .. | .. | .. | .. | .. | .. | 16 | 14 | 1 |
| August. | .. | .. | .. | .. | .. | .. | 6 | 16 | 9 | .. |
| Sept ... | .. | .. | .. | .. | 2 | 7 | 13 | 8 | .. | .. |
| Total .. | 1 | 8 | 26 | 38 | 30 | 35 | 45 | 65 | 24 | 1 |

These tables give a comparative view to every tenth degree of the temperature at 8 a. m., in the cholera years of 1832 and 1834.

January, 1834, was a month of low temperature, the mercury at 8 a. m. being only once above the freezing point at 8 a. m. Max. 41° min. -2.

February. A mild month. On the 22nd a storm of thunder and lightning, ther. 42°, succeeded by flurries of snow, and ther. 18°.

March. High temperature. Bay of Toronto free from ice on the 14th, nearly a month earlier than usual, On the 19th and 20th heavy rain and gale, thermometer 48°. Fall of rain, 1.21, succeeded by cold, clear weather, snow, and ther. 18°.

April. A month of high temperature, therm. 61° on the 13th at noon, 66° on the 16th, high range. One thunder storm. Cold and variable towards end.

In May there was snow on the 13th, therm. 33°. Four days of thunder. Cold and variable first half of the month, and the highest temperature 72° at 8 a. m. on the 24th.

June. A cool month, therm. only once above 70°, viz., 77° noon of the 9th. Considerable fall of rain.

The remembrance of the desolating scourge had in a great measure faded from the minds of many when the afflicting news arrived, that the cholera was once more amongst us. Not a few indulged a too confident hope that the plague was stayed for ever, and even in the height of its fury, it seemed to lull for a while, like the hurricane, only to burst forth again with redoubled violence. It was imagined that the disease was of a milder type at this its second arrival, and one thing is certain, that it did not inspire that dread and consternation which so strongly marked its former visit. People had become familiarized with its most shocking features, the character of the disease was better understood, many precautionary measures, before neglected, were adopted, but it may well be questioned whether it abated any thing of its former malignity. It was remarked at the time, and indeed it is a familiar truth as regards all similar visitations, that nothing does so effectually predispose the system to the attacks of disease as that fear and anxiety which naturally attended the first appearance of a malady marked by such terrible characteristics. Ward, in his travels in Mexico, speaking of the yellow fever, observes, that "a predestinarian would have a much better chance of escaping than one over anxious," and this was specially verified as regards the cholera. We observe that physicians, clergymen, nurses, and others, who were constantly in communication with the dying and the dead, almost invariably escaped, while many no doubt fell victims solely from the influence of panic. In the former, familiarity with scenes of horror, divested them of that morbid sensitiveness which as much as any other cause invited the attacks of the destroyer. Consequently the alarm which accompanied the former visitation having in a great measure subsided, the cholera of 1834 was thought to be of less malignant quality. And yet the facts of the case would scarcely seem to warrant the conclusion. The first case of cholera in 1834, at Quebec, occurred on July 11th, and in Toronto July 28th, and in less than one month, viz., by August 22nd, the number of deaths in Toronto amounted to 423; an extraordinary mortality, when it is considered how many of the inhabitants had left the City. We now revert to the consideration of the two months in which the cholera prevailed, July and August.

July was a month of high temperature, abounding in sultry days, heavy showers, great consequent evaporation, and remarkable for the number of thunderstorms, many of great severity. From 21st to 26th was a continued series of these storms, accompanied by 3.25 in. of rain; and so far from the pestilence being mitigated, as some have argued, by these agents, it seemed to burst forth with fresh fury. The heavy showers and burning sun roused into active operation many a deleterious influence, which under other circumstances might have remained dormant.

August resembled July, though somewhat lower in temperature. On September 12th was a white frost.

Comparing then the seasons of 1832 and 1834, commencing with

January and ending with September, we obtain the following results, speaking in general terms, but an inspection of the tables will furnish more minute particulars. (*Vide*, pp. 24–5.)

1832 was a season of backward spring, cool summer, moderate rain. 1834 in every particular the reverse. But in electric phenomena the greatest difference is discernable; and as much has been said and written upon the supposed connexion of such agencies with epidemics, the results of two years differing so materially in these two particulars are worthy of notice The total number of days of thunder in the first nine months of 1832 was 10, in 1834 was 23, and the latter of much greater severity. As was before observed, so far was the cholera from being abated by these thunderstorms, that it seemed to rage more furiously. Miriam, who has been indefatigable in his meteorological researches, observes, "It is frequently remarked that lightning cools the air. Our records of lightning and our hourly records of temperature of the atmosphere, compared together, shew that a great majority of thunderstorms in summer are immediately followed by an increase of temperature." This coincides with our own experience of 1834, as was before observed.

In concluding this subject we may observe, that this year was of itself not only remarkable for electric phenomena, but was likewise ushered in by one of the most remarkable ever witnessed. I allude to the meteors of November, 1833. The weather previous had been mild and showery, and on the night of the 12th, and nearly to the dawn of day, the sky was illumined with millions of meteors, darting from the zenith to the horizon like sky-rockets, thick as the flakes of a snow-storm. In one instance a meteor exploded with considerable noise, leaving behind it a brilliant train of light which lasted some minutes, This splendid celestial exhibition was seen in North and South America and in the West Indies.

The following table, extracted from the New York *Spectator*, exhibits the ratio of deaths above the average for July, 1832:

| | |
|---|---|
| 1 to 2 | same as usual. |
| 2 to 5 | 4 |
| 5 to 10 | 4 |
| 10 to 20 | 8 |
| 20 to 30 | 12 |
| 30 to 40 | 14 |

| | |
|---|---|
| 40 to 50 | 12 |
| 50 to 60 | 16 |
| 60 to 70 | 8 |
| 70 to 80 | 8 |
| 80 to 90 | 8 |

We see from this statement that in the classes between the ages of 20 and 60, the proportion swells twelve to sixteen times the mortality of average. In the classes beyond that age it sinks again to eight, and in children varies from 0 to 4. Cholera no doubt made the greatest havoc among the dissolute and intemperate. Few confirmed drunkards live beyond the age of sixty, and if the above calculations are reliable, the table above strongly confirms this opinion.

To conclude, whether this epidemic is independent or not of climate and its conditions, one thing is certain, both with respect to it and other diseases, that human agency is far more actively engaged than many are willing to admit. Experience of the past has abundantly testified that many evils which are man's heritage may be greatly aggravated or alleviated, and even the mortality which cannot be altogether averted may be signally diminished. Had the sanitary measures which are now in fashion, imperfect as they still are, been in existence in 1832; could some Hercules have purified that Augean stable, muddy York,—closed the groggeries, ventilated the dwellings, and applied all our modern disinfectionals of 1861,—the pestilence would have been stripped of much of its horrors, and many a valuable life would have been saved which was sacrificed to the neglect of those means of prevention which were in the reach of all.

## NOTES ON LATIN INSCRIPTIONS FOUND IN BRITAIN.

### PART IX.

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57. The concluding article of Part VIII. was devoted to the examination of the simpler forms of inscription on the pigs of lead found in Britain. To the remarks, which have been offered there, it seems unnecessary to add more than the observation that those pigs exhibit

the three constructions, which were used in such inscriptions, viz.: the nominative, the genitive, and the ablative. In n. (2) TI · CLAVDIVS · CAESAR · AVG · P · M · TRIB · P · VIII · IMP · XVI · DE · BRITAN, we have the nominative, indicating, as I think, that the object was taken as spoil: in n. (8) IMP · CAES · DOMITIANO · AVG · COS · $\overline{\mathrm{VII}}$. we have the* ablative indicating the time, scil. from September 13 to December 31, A.D. 81; and in n. (11) IMP · HADRIANI · AVG · and n. (12) IMP · DVOR · AVG · ANTONINI ‖ ET · VERI · ARMENIACORVM we have the genitive, indicating that the blocks were† the property of those emperors, being the produce of mines worked for their benefit. N. (7) IMP · DOMIT · AVG · GER · DE · CEANG · I have read in the nominative, conformably to the unquestionable construction of n. (2), whilst I have preferred regarding nn. (5 and 6) IMP · VESP · $\overline{\mathrm{V}}$ : : T · IMP · $\overline{\mathrm{III}}$ · COS and IMP · VESP · $\overline{\mathrm{VII}}$ · T · IMP · $\overline{\mathrm{V}}$ · COS in the ablative, indicating the time, although the DE · CEANG on their sides excited a doubt between that case and the nominative. I shall now proceed to the consideration of the doubtful portions of the remaining inscriptions,‡ reserving for special notice n. (1) BRITANNIC**AVG II, and n. (9) CAESAR***** VADON, which are imperfect, also n. (4) NERONIS AVG·EX KIAN $\overline{\mathrm{IIII}}$ COS BRIT, which is unique. These doubtful portions are (*a*) *LVT—in

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* Mr. Yates, in a valuable "Memoir on the mining operations of the Romans," *Proceedings of Somersetshire Arch. and Nat. Hist. Society, Taunton*, 1859, observes relative to this inscription: "I conceive that it should be read in the ablative case, *Imperatore Cæsare Domitiano Augusto consule septimum.* On this supposition the mine may have been worked by private hands." The first of these remarks is unquestionably correct: *Domitiano*, followed by *Cos.* VII., is certainly not the dative. The latter is probable, as it is questionable whether under the emperors any mines were worked except for their benefit, or that of the individuals who rented them.

† Thus Mr. Yates, *On the mining operations, &c.*, p. 2, observes.—"The retention of mines by government may account for the inscription found on pigs of lead, such as IMP · HADRIANI · AVG, in the genitive case, showing that they belonged to the Emperor. In other instances the name of an individual, occurring in the genitive, shows that he rented his mine from the government, *e. g.*, L · ARVCONI · VERECVNDI. This implies that the lead was the property of Lucius Aruconius Verecundus." In article 48 I have noticed an inscription, having the name in the nominative, on a block, the product, as I believe, of a rented mine.

‡ From Mr. Yates' Memoir, pp. 21, 22, 23, I learn that two pigs of the Emperor Severus, probably imported from Britain, have been found in France, one at Lillebonne, the ancient Julia Bona, and the other at Sassenay near Chalons-sur-Saone, not far from a Roman road, which led to the coast opposite Britain. On one of these are the inscriptions LVICVC and DL'P. M. Canat, President of the Historical and Archæological Society of Chalons, in a Memoir on the subject, does not attempt to interpret the first of these, but infers from the accent in the second, whereby L and P are separated, that the letters denote numbers, and thus interprets DL'P as meaning 550 pounds in weight, P standing, as is common, for *Pondo.* But as this does not at all correspond with the actual weight of the pig, he "conjectures that it [*Pondo?*] here denoted the *semis* or *half-libra.*" In this way the marked and the actual weights agree within 2 kilogrammes and 8 hectogrammes, "the loss of which may very well be ascribed to accident, waste, or abrasion." There is no authority, so far as

(3) TI · CL · TR · LVT · BR · EX · ARG
(10) IMP · CAES · HADRIANI · AVG · MET · LVT
(14) C · IVL · PROTI · BRIT · LVT · EX · ARG · ;
(*a*) MET · LVT ·—in n. 10 ; (*a*) METAL · LVTVD ·—in n.
(13) L · ARVCONI · VERECVNDI · METAL · LVTVD · ;
(*b*) EX · ARG ·—in nn. (1) and (14) ; and (*c*) TR · and BR ·—in n. (3).

(*a*) LVT ·, MET · LVT ·, METAL · LVTVD ·—As these readings seem to be unquestionably correct, I shall offer no criticism on the interpretations, which have been given, of erroneous readings, such as POT · for LVT · in n. (3), MEM · L · VI for MET · LVT in n. (10), and LVND for LVTVD in n. (13), but shall limit my remarks to the explanations, which have been proposed, of the readings as given above. Mr. Crane, *Archæologia*, xiii. 405, regards LVT . in n. (3) as standing for LVTVM, and reads the whole inscription thus:—"*Ti*[berii] *Cl*[audii] *tr*[ibutum] *lut*[um] *Br*[itannico] *ex arg*[ento]—the tribute of Tiberius Claudius paid out of British money."

Lysons, *History of Derbyshire*, p. ccvi., traces LVT · and LVTVD · to LVTVDARVM, the Roman Station mentioned by *Ravennas* as next to *Derventio*, and believed to be represented by the modern *Chesterfield*.

Mr. Bateman, *Vestiges of the Antiquities of Derbyshire*, p. 135, observes :—

> "These inscriptions, [nn. (3), (10), and (13)] have given rise to various conjectures, and accordingly to a great display of erudition; but if we allow the LVT · and the LVTVD · to be the contractions of LVTVDARVM, the name of a Roman station next in order, according to Ravennas, to Derventio, or Little Chester, and which is supposed to be Chesterfield, much of the difficulty will vanish. The first [n. (10)] will then be found to bear the name of the Emperor

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I am aware, for the inference from the accent, nor for the use of P or *Pondo* as denoting the *semis* or *half-libra*. The accuracy of the readings seems to me very doubtful. Can it be that the letters given as LVICVC, are really LVT · CANG?

[*] Dr. Thurnam, *Historical Ethnology of Britain*, p. 100, *Cran. Brit., Dec.* 3, mentions "the inscription LVTVM EX ARGENT on various British pigs of lead of the date of Claudius and his successors." There is no authority, so far as I am aware, for this statement; pigs have been found bearing LVT ·, LVT · EX · ARG ·, and EX · ARGENT ·, but there is no example either of LVTVM EX ARGENT ·, or of LVTVM alone.

Hadrian, in connexion with the name of the metallic district, of which it is probable that Chesterfield was then, as Wicksworth has subsequently been considered, the regulating town; hence this inscription would mean no more than that the block of lead upon which it was stamped belonged to the Emperor Cæsar Hadrian Augustus, from the metallic district of Lutudarum. The second [n. (13)] would, under a similar interpretation, be stamped with the name of its owner, a proprietor of some mines, perhaps, or a merchant, Lucius Aruconius Verecundus, with the addition, as before, of the name of the mining district. The third inscription [n. (3)] appears to mean that the lead upon which it is impressed formed part of the tribute due to Tiberius Claudius from the mines (silver or lead) of the British Lutudæ or Lutudarum. These interpretations [which were first suggested by Mr. Lysons and Mr. Crane] are by far the most conformable to custom and common sense."

The suggestion of Mr. Lysons has also been adopted by Sir Henry Ellis, *Townley Gallery*, ii. p. 290; Mr. Way, *Jour. Arch. Inst.*, 1859, n. 61, p. 25; and apparently by Mr. Yates, *Mining Operations*, p. 10. Mr. C. R. Smith, *Journal Arch. Assoc.*, v. p. 228, is of opinion that LUT· is a contraction of LVTVM or LVITVM, signifying *washed* or *purified*; and he refers in illustration to the use of *elutia* in Plin. *Hist. Nat.* xxxiv. 16, where it is applied to the washing by water of tin from the vein in the gold mines of Spain and Portugal. Mr. Wright, *Celt, Roman, and Saxon*, p. 238, adopts this opinion as undoubtedly correct.

In favour of the interpretation received by Mr. Smith and Mr. Wright, may be cited the statement of Professor Phillips, whose authority on such points is justly esteemed of high value, that "he is strongly of opinion that much of the lead ore was collected from the surface by aid of water, artificially directed. The process, in fact, is described by Pliny, in terms so exactly applicable to the modern 'hushes' of Swaledale, that no doubt can remain of this custom, which is now esteemed rude and semi-barbarous, being of Roman or earlier date in Britain."—'*Ancient Metallurgy in Britain*,' *Journal Arch. Inst.* 1859, n. 61, p. 17.

As to MET· there is no difference of opinion, all agreeing in tracing it to *metallum*.

(*b*) EX·ARG·—These letters are found, as we have already seen, in nn. (3) and (14), and an expansion of them appears on the side of the block, n. (4), in the form EX·ARGENT. Mr. Pegge, *Archæologia*, ix. p. 45, read them *ex argent*[*o*], and regarded them as denoting that the *silver* had been extracted from the lead. He cites in illustration the remarks of Mr. Pennant, *Tour in Wales*, i. p. 58, but notice the difficulty that *ex argento* rather implies the extraction of lead from silver than of silver from lead. Dr. Gifford proposed *ex argent*[*aria*] and Sir Henry Ellis, *Townley Gallery*, ii. p. 291, suggests *ex argent*[*ariis*], the sense intended by each being, I presume, the same, although the number is different, scil. from the silver mine or mines. Sir Henry Ellis remarks—"The known richness of the English lead, with which silver has been sometimes found mixed in large quantities, may serve to explain the word *ex Argentariis*."

Mr. Roach Smith, *Journal of Arch. Assoc.* v. p. 228, remarks—"*Ex argent.* refers to the separation of the silver from the ore."

Mr. Wright, *Celt, Roman, and Saxon*, p. 238, observes:

> "EX ARG· or EX ARGENT. is explained by a passage of Pliny, who informs us that lead ores are found under two different forms, either in veins by itself or mixed with silver. The latter had to go through a more complicated process of extraction, which is referred to by the words of the inscription—*Lutum ex argento*—and which it seems the Romano-British Metallurgist considered it necessary to specify."

In Prof. Phillips' paper, "*Ancient Metallurgy in Britain*," pp. 17, 19, we find the following statement on this point:

> "The Romans employed lead in pipes (*fistulæ*) and sheets, which were soldered with alloy, as already mentioned. The lead was previously refined and its silver removed; the silver, indeed, being often the object of the enterprise."
>
> "The mines of Middleton and Youlgreave (Aldgroove) in Derbyshire, from which the Lutudæ sent not only lead but 'exargentate' (that is to say refined) lead from which the silver had been removed, use to this day the pig of the same weight of 1½ cwt. of similar shape and similar mark to that of eighteen hundred years' antiquity."

Mr. Yates, *Mining Operations*, p. 19, remarks:

> "The letters are supposed to stand for *ex argento*, and to intimate that the lead was extracted from silver. This seems to be the true explanation, although, I think, we might read EX ARGENT[IFODINIS]. Even in the present day, we find that where the galena contains a large proportion of silver, as is frequently the case in the British Isles, the mines are not called lead mines, but silver mines. Also the litharge, which is an impure oxide of lead, formed on the surface of the melted mass during the process of refining, is called *argenti spuma*, 'froth of silver,' not froth of lead. It would seem consistent with these ideas to regard the lead as extracted from silver, rather than the silver as extracted from lead, although the ore really contains a far greater proportion of lead than silver."

(*c*) TR · BR.—These abbreviations are found in n. 3, Mr. Pegge, reading POT · for LVT ·, regarded TR · as standing for *Tr*[ibunitia] i. e. *tribunitia pot*[estate]; Mr. Crane proposed *tr*[ibutum]; Dr. Gifford, *tr*[iumviri]; Mr. Yates apparently adopts Mr. Crane's suggestion. As to BR · Mr. Pegge regarded it as standing for *Br*-[itannicus], agreeing with *Cl*[audius]; Mr. Crane, *Br*[itannico], agreeing with *argento;* Dr. Gifford, *Br*[itannorum] governed by [*] *argentaria;* and Sir Henry Ellis, *Br*[igantum], governed by [†] *argentariis,* in which opinion Mr. Yates seems to concur.

As the principal opinions on the doubtful portions of the inscriptions have been stated, let us proceed to enquire to which the preference should be given, and whether any other more probable interpretation can be proposed. As to LVT ·, MET · LVT ·, and METAL · LVTVD ·, there can, I think, be but little doubt that the explanation of Mr. Lysons is to be preferred to those offered by Mr. Crane and Mr. Smith. There is a *prima facie* probability that MET · and LVT · are shorter forms of METAL · and LVTVD ·; moreover, the blocks on which these abbreviations occur, scil. those bearing nn. (3), (10), (13) and (14), have all been found either in Derbyshire, where was the station '*Lutudarum*,' or in its neighbourhood. *Mansfield*, about 6 miles from which n. (14) was found, is only some 12 miles distant from *Chesterfield*, which is believed to be on or near the site of the ancient '*Lutudarum*.' The only exception is in the case of the four blocks bearing n. (3), which were found in Sussex, but it may reasonably be inferred relative to these, as to other pigs under similar circumstances, that they were on their way to the coast for shipment to the continent, and were probably the product of mines in Derbyshire, as one bearing the same inscription was found at Matlock in that county. I have said, that there is a *prima facie* probability that MET · and LVT · are shorter forms of METAL · and LVTVD ·: this probability seems to me to reach almost certainty in the case of MET · LVT · in n. (10), but I rather question the inference as it relates to LVT · in nn. (3), and (14). I strongly suspect that LVT ·—perhaps an abbreviation of LVTVM—represents the Celtic designation of lead or lead-ore, to which I would trace LVTVDARVM, as a derivative, signifying the place where the veins were found and worked, *i.e.* the lead mines.

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[*] I am not sure that this was the construction intended by either: perhaps it was *Lutudari Britannorum* and *Lutudari Brigantum*, i.e., at Lutudarum of the Britons or of the Brigantes.

This suspicion is strengthened by the fact that we can trace this designation of the metal in *lood* in Dutch, *loth* in German, *lod* in Danish, *lód* in Icelandic, *lod* in Swedish, *lot* in Russian, **luaidh* in Gaelic, and *læd* or *lead* in Anglo-Saxon, whence our term is derived. It also derives some support from the remarkable omission in the inscriptions of the ordinary Latin designation of the metal—*plumbum*.

But a question arises as to *Lutudarum*—in what case is it? Is it the nominative singular of the second declension? the genitive plural of the first declension? or the genitive plural of the third declension? Dr. Gifford and Sir Henry Ellis, when they read LVT · in n. (3) as Lut[udari] seem to have adopted the first opinion. Similarly Sir Henry Ellis, p. 290, reads LVTVD · Lutudar[ense], *i. e.*, I presume, deriving this adjective from *Lutudarum* as the nominative. Prof. Phillips, in the passage which I have cited, p. 32, has adopted the second opinion, but seems to have mistaken *Lutudæ* for the name of a people or tribe. Mr. Yates is inconsistent on this point, for in the same page, p. 11, he says, "at Lutudarum" and "to Lutudar," leaving it uncertain whether he adopted the first or third opinion. Similarly Mr. Bateman, p. 31, speaks in one sentence of 'the metallic district of Lutudarum,' and in another, the next but one, uses the terms—'the mines of the British Lutudæ or Lutudarum.' Of these I prefer *Lutudæ*, the nominative plural of the first declension, and hence form *Lutudensis* as its adjective.

There is also another question, which we have not yet considered, as to *metallum*, of which MET · and METAL · are abbreviations. Does it signify metal or mine? It is scarcely necessary to remark that there are examples of both significations in ancient authors. I am inclined to adopt the latter, and as to construction prefer the nominative.

Let us now take up the forms EX·ARG· and EX·ARGENT. There can, I think, be no doubt, that the *prima facie* interpretation of *ex argento* inscribed on an object would be that that object was *made of silver*, as we have *ex arg.* in Orelli, n. 1691 ; now this is certainly inapplicable to these pigs, for they are, I presume, unquestionably made of lead. Adopting the same signification of *ex*, we may suggest another expansion—*ex argent*[ario plumbo] ; but the obvious objection to this reading, otherwise plausible, is that the *argentarium plumbum* of Pliny was not lead but tin.

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* Can the combination of this and the Gaelic *udhe*, the end of a journey, be the origin of *Lutudæ—Luaidhudhe*, the lead station?

The interpretation, which would probably next present itself, is *derived, extracted from silver;* and this is adopted as the true signification by Mr. Yates, who, however, seems to prefer *argent*[ifodinis]. It may be stated in favour of this view, and also of the opinions that we should read *argent*[ifodinis], *argent*[aria], or *argent*[ariis], that as silver was probably the principal object that the Romans sought for in these operations, they may have called their works, 'silver-mines,' instead of 'lead-mines.' Mr. Yates also suggests: "Even in the present day we find that where the galena contains a large proportion of silver, as is frequently the case in the British Isles, the mines are not called lead mines, but silver mines."

The interpretation of EX·ARG· and EX·ARGENT; as denoting that the silver had been extracted from the lead, seems more conformable to present usage. A passage in Strabo, p. 198, *ed. Falconer Oxon.* 1807, in which he notices a kind of lead found in Spain, which contained so little silver, that it was not remunerative to extract it, is sufficient to prove that the ancients were acquainted with some process for effecting this separation; and the same inference may be drawn from the obscure statement in Pliny, *Hist. Nat.* xxxiv, 47, referred to by Mr. Wright: *Plumbi nigri origo duplex est: aut enim sua provenit vena nec quidquam aliud parit;* aut cum argento nascitur mixtisque venis conflatur. *Ejus qui* primus *fluit in fornacibus* liquor stannum *appellatur; qui* secundus, argentum: quod remansit *in fornacibus* galena, *quæ est tertia portio additæ venæ. Hæc rursus conflata dat* nigrum plumbum *deductis partibus duabus.*

If these words be taken in their apparent sense, it is evident that Pliny has made statements on the subject, which are wholly at variance with modern Mineralogy and Metallurgy. No ore is known to exist in any part of the world, which at one smelting process would yield successively *stannum, argentum,* and *galena.* The only satisfactory explanation of the passage seems to be that suggested by Kopp, *Geshichte der Chemie,* iv. 127, that three different smeltings are referred to, scil. melting out the argentiferous lead, removal of lead by oxidation, and reduction of the so formed litharge or oxide of lead.

But if this reading and interpretation of EX·ARGENT· be adopted, what is the grammatical construction? It is impossible that the words *ex argento,* if regarded as complete, can express 'the silver being extracted,' or that the lead was, as Prof. Phillips calls it, 'exargentate.' The only grammatical explanation which seems at all probable, is to regard EX as an abbreviation of the participle of some compound verb, such as *excoquo,* and the construction as that of the ablative absolute, scil. **ex*[cocto] argent[o].

After the best consideration that I have been able to give to this perplexing phrase, I am disposed to prefer *ex argent*[aria] (scil. *vena* or *fodina*), or the equivalent *argent*[ifodina], but in the sense that the marks EX · ARG · or ARGENT · indicated that those blocks, on which they were inscribed, were the product of a mine of argentiferous lead—that they were made from a vein which had been found to yield silver, and consequently that those marks were a sort of guarantee that the blocks which bore them contained that precious metal in combination with the lead of which they were composed. The grounds of this interpretation are, that as the Romans were acquainted with a process for extracting silver from lead, the blocks of lead would command a higher price, if they were known to contain silver—and that British lead varies so much in this respect, some veins, as in Derbyshire and elsewhere, containing but a trace, that it was necessary to use such distinctive marks, in order to enhance the market value. But we have yet to consider TR· and BR· As these abbreviations are found only in one instance—scil. n. (3)—we shall take up the inscription itself—

TI · CL · TR · LVT · BR · EX · ARG ·

The following readings have been proposed:—*Ti*[berii] *Cl*[audii] *Tr*[ibutum] *Lut*[um] *Bri*[tannico] *ex ar*[gento], by the Rev. T. Crane; *Ti*[berii] *Cl*[audiani] *Tr*[iumviri] *Lut*[udari] *Br*[itannorum] *ex arg*[entaria, by Dr. Gifford;* and *Ti*[berii] *Cl*[audiani] *Tr*[iumviri] *Lut*[udari] *Br*[igantum] *ex arg*[entariis], by Sir Henry Ellis.† The first question which presents itself here is, does this inscription refer to the Emperor Claudius? I must confess that I have strong doubts on this point. The absence of any title whatsoever in this case, whilst in every other instance in which an Emperor is named, we always have some one or other, warrants the suspicion, that the reference to the Emperor Claudius is erroneous. I am inclined to think that TI. CL. TR. are the initials of some private individual, such as those named in nn. (13) and (14).

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* And yet *excoctum argentum* is used in the sense—refined silver.

† The words of Sir Henry Ellis are:—"Dr. Gifford thought this inscription stood for *Tiberii Claudiani Triumviri Lutudari Britannorum ex argentaria.* We are inclined ourselves to read the last words *Lutudari Brigantum ex argentariis.*" From this statement I infer that he adopted Dr. Gifford's readings in the first three words, but in what sense either understood them I am unable to conjecture.

We have an example of similar abbreviations on the medicine stamp found at Wroxeter in 1808. According to Mr. Wright's readings, *Journal of Archæol. Assoc.*, vol. 1859, p. 317, the name of the empiric who prepared it, was TIB · CL · M · *i.e. Tib*[erii] *Cl*[audii] *M*[edici], but both reading and expansion seem very doubtful. In the *Celt, Roman, and Saxon*, p. 244, he read IBCLM, and thus Mr. Way and Dr. Simpson, the latter of whom proposes the expansion *J*[ulii] *B*[assi] *CL*[e] *m*[entis]. Similarly also we find the abbreviations of names on potters' work, in Fabretti, p. 503, and Orelli, ii., p. 372. It is of course impossible for me to surmise for what *cognomen*, according to this supposition, TR· stands, but I suppose that it was such as *Tr*[ophimus] or *Tr*[ajanus] of which we have examples with *Ti*[berius] *Cl*[audius].

On comparing nn. (3) and (14) a difference of order—LVT · BR · and BRIT · LVT ·—is observable, but this is, I think, nothing more than the variety of collocation of the adjective, which is often found.

I would read nn. (3) and (14) thus:—

*Ti*[berii] *Cl*[audii] *Tr*[****] *Lut*[**] *Br*[itannicum] *ex arg*[entaria];

*C*[aii] *Jul*[ii] *Proti Brit*[annicum] *Lut*[**] *ex arg*[entaria].

We may now proceed to nn. (10) and (14).

IMP. CAES. HADRIANI. AVG. MET. LVT.

*Imp*[eratoris] *Cæs*[aris] *Hadriani Aug*[usti] *Met*[alla] *Lut*[udensia.]

L. ARVCONI. VERECVNDI. METAL. LVTVD.

*L*[ucii] *Aruconi*[i] *Verecundi Metal*[la] *Lutud*[ensia].

Mr. Yates, p. 11, remarks: "Aruconius appears to be a name of British origin. Perhaps this Lucius had removed to Lutudar from Ariconium, the modern Weston in Herefordshire and an important mining station of the Romans." If there be any connexion between *Aruconius* and *Ariconium*, it seems more probable that the name of the place was derived from the name of the person than v. v.

Nn. (1) and (9) remain for consideration before we proceed to n. (4).

### *N. (1) BRITANNIC** AVG II

Mr. Way, who was the first that noticed this pig, refers the inscription to Britannicus, the son of Claudius, and assigns the date "about AD. 44–48." In confirmation of this reference it is stated by Mr. Way that "Mr. Franks, [who had opportunities of examining the block in the British Museum] informed him that the inscription may be read BRITANNIC :: :: AVG F :: (Augusti filius)." Mr. Yates, p. 17, remarks: "On examining the object itself, I was satisfied that the last letters are FIL, which is the reading adopted by Mr. Roach Smith, and not II, or IMP·, as other antiquaries have supposed. Hence, I conclude that the inscription, which is of unusual historical interest, may be thus restored:

BRITANNICI CLAVDII AVGVSTI FILII."

As the wood-cut, illustrating Mr. Way's remarks, presents II· after AVG·, I have so represented those letters in the copy which I have given, but I concur in Mr. Yates's reading and expansion.

### N. (9) CAESAR***** VADON.

Mr. Smith, *Journal of Archæol. Assoc.* v. p. 556, observes:

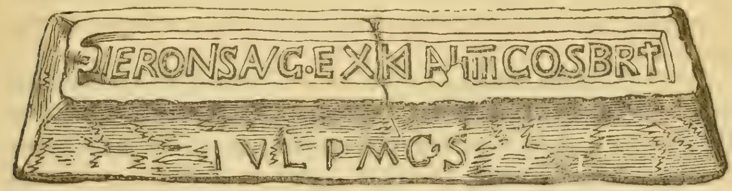
> "Unfortunately the inscription, which originally had been well cut, has so perished from oxidation, that its restoration cannot with safety be proposed, especially as it exhibits a reading different from those of a similar description, which are yet preserved or on record. Camden mentions, that several of these pigs of lead had been found in Cheshire, inscribed IMP·DOMIT·AVG·GER·DE·CEANG·, and IMP·CAES·DOMITIAN·AVG·COS·VII·BRIG· One similar to the latter of these was found, in the last century, at Hayshaw Moor, in Yorkshire, and one on Hints Moor, near Tamworth, reading IMP·VESP·VII·T·IMP·V·COS·DE·CEANG· The specimen [bearing CAESAR***** VADON] was most probably inscribed to Domitian."

Mr. Smith justly regarded the restoration of the fragment as hazardous. In addition to its imperfection, it has peculiarities which are not found in the other extant inscriptions on pigs of lead. But there are no grounds, so far as I can see, for his reference of it to Domitian. The absence of IMP· and AVG· would certainly suit his position at one period of his life, but it is impossible to make out his name from the extant letters. DO are the first two letters, but they are followed by a form which seems necessarily to be either N or VA.* I have myself nothing further to suggest than that it is possible that the last word may have been DOVA, another form of DEVA.

---

* On the side of this pig are the letters V·EIP·C or, as they are otherwise read, V·ETP·C or V·FTP·C, which, Mr. Way observes, probably denote its weight. The only ground for this opinion seems to be the occurrence of F, which may stand for *Pondo*. Can it be that the letters are V·EID·O, marking the time, scil. *quinto* (*ante*) *idus Octobres?*

We now proceed to n. (4), the inscription on the block represented in the subjoined woodcut.



In *the Journal of the Archæological Association,* v. p. 227, Mr. C. Roach Smith offers the following remarks on it:—

> It is inscribed on the top, in letters an inch in length, NERONIS · AVG · EX · KIAN · IIII · COS · BRIT ·; on one side HVLPMCOS ·; on the other EX · ARGENT · and CAPASCAS ·; with the numerals XXX. This inscription is peculiarly interesting as referring to the Cangi at an earlier date [than on the pigs of the time of Vespasian and Domitian, A. W.] the name being spelt as pronounced, *Kiangi*, and just previous to the reverses of the Romans in Britain, from the courage and skill of the heroic Boadicea. Nero was the fourth time consul the year before; and this pig of lead would seem to have been on its way from the country of the Cangi towards the south, for exportation, composing probably part of the tribute, the harsh exaction of which was one of the causes of the insurrection. The *Brit.* must be considered as referring to the metal or the province, and not intended for *Britannicus*, as before observed on the *Br.* in the inscription of Claudius. The lateral marks are not altogether [at all?] to be satisfactorily explained, except the *ex argent.*, which occurs in other instances and refers to the separation of the silver from the ore."

In Mr. Wright's *Celt, Roman, and Saxon,* p. 237, we have an additional observation by Mr. Smith on the inscription:

> " As Nero never assumed the title of Britannicus, and as the numerals precede the *cos*, I suspect the inscription should be read—
>
> (Plumbum or Metallum) Neronis Aug. cos. iiii. Ex. Kian. Brit.
>
> The P · M · Cos · may belong to the above, and the rest be the name of some superintendent."

The obscurity of this singular inscription fully justified Mr. Smith's resort to conjecture, and the suggestions which he offers are, as usual with him, worthy of consideration. But the tone of his remarks is likely to mislead; and perhaps did mislead Mr. Yates, when he regarded this inscription as "evidently referring to the Ceangi." Mr. Smith says that "this inscription is peculiarly interesting as referring to the Cangi at an earlier date, the name being spelt as pronounced, *Kiangi.*" Now this statement, as to pronunciation and orthography at an earlier date, is wholly conjectural, without any authority to support it.

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* In the original, the transverse line is not in the same position as in N, but connects the other extremities of the perpendiculars, *i.e.* as if it were VA ligulate, without the bar of the A.

Nor is the suggested transposition of *ex Kian.* and *iiii cos* warranted by precedent, or at all probable. Moreover a very strong objection to Mr. Smith's reading is derived from the difference of the prepositions. In other blocks where the *Ceangi* are named we have the preposition *de,* whilst here we have *ex.* Again, in those other blocks we have *Ceang.*, but here K is substituted for C, *i* for *e*, and *g* is omitted.

But if we give up the reading *ex Kiangis,* what solution is there of the difficulty? The only conjecture which I can offer on the subject is, that the words EX · KIAN express a date, *scil.* EX · K[ALENDIS] IAN[VARIIS].

It is scarcely necessary to say, that there are examples of K · IAN · being used for *Kalendis Januariis:* and the only inquiry which seems necessary, relative to this reading, is as to the reason of the date being stated in the inscription.

We know from Pliny xxxiv., ch. 17, that there was a law prohibiting more than a limited production of lead in Britain—*ne plus certo modo fiat*—and it seems probable to me that with a view to this law, the blocks, at least in some reigns, bore marks of the time at which they were made, so that it might be known what blocks were manufactured, and consequently what quantity of lead was produced during the year. The mention of the consuls, or not unfrequently of one, especially the Emperor, was, as is well known, the recognised mode among the Romans of distinguishing the year. But it may be asked —why mention *Kalendis Januariis* when that day was commonly known to be the first of the consular year? To this it may be answered that it was not uncommon for the Emperors to enter on the consulship at different periods of the year, and hence it may have been necessary to specify in this case the date of the commencement of the Emperor's fourth consulship. Another reason, peculiar to Nero, for this specification, may be, that it conveyed a flattering reference to his having rejected the proposition of the Senate, that the year should begin with the month of December, in honor of his birthday—the 15th of December. Tacitus *Ann.* xiii. 10, notices this fact:—"*Quamquam censuissent patres ut principium anni inciperet mense Decembri, quo ortus erat, veterem religionem* Kalendarum Januariarum *inchoando anno retinuit.*"

Such forms as $\overline{\text{IIII}}$ · COS ·, instead of COS · $\overline{\text{IIII}}$ ·—a transposition which Mr. Smith notices—are rare: but both forms seem to have been used.

In Henzen, n. 6770, we have :—DOMITIANO · $\overline{\text{II}}$ · COS ·, VESPAS · $\overline{\text{X}}$ · COS ·, DOMIT · $\overline{\text{VIIII}}$ · COS ·, DOMIT · $\overline{\text{XIIII}}$ · COS ·, NERVA · $\overline{\text{II}}$ · COS . It may, however, be inferred, as I think, when the numeral is placed before instead of after COS ·, that the date of the inscription is not during but after the expiration of the consulship.

BRIT · I regard as standing for BRIT[ANNICVM], as is common, and agreeing with *lutum* or it may be *metallum* understood. The pig was, most probably, thus marked to distinguish it as the product of Britain, from others manufactured elsewhere, as in Spain.

We now proceed to consider the lateral inscriptions. Mr. Smith reads these marks as HULPMCOS · on one side, and EX ARGENT · and CAPASCAS · with the numerals XXX on the other; and thus they were also read by the writer in the *Gentleman's Magazine*, liii. p. 936. In the *Monum. Hist. Brit.* they are given :—

HUL P M CO, EX ARGE N
CAPA ƆC? IV
XXX

and from the wood-cut it seems probable that some letters are effaced before IVLPMCOS. In such uncertainty regarding the true readings, it might, perhaps, be more judicious for me to follow Mr. Smith's example in *the Journal*, and leave them as I found them. But as in such cases even an attempt may be useful, I venture to offer some suggestions. From IVL and COS ·, I draw the conjecture, that there may be a reference to the circumstance, that Nero held his fourth consulship only for six months. His colleague in that year (A.D. 60) was Cornelius Lentulus, and in their places Velleius Paterculus and Pedanius Salinator were *suffecti* on the Calends of July. See Borghesi, *Bull. Inst. Archæol.* 1846, p. 174, and Henzen, 5407. This conjecture leads to another, that the date mentioned here indicates the end, as *ex Kalendis Januariis* denoted the beginning of the period during which the set of pigs, of which this was one, were manufactured. But what of PM? It is plain that the ordinary interpretation of these *notæ* as *pontifex maximus* is inapplicable here, and that we must look for some other more appropriate expansion. They may, possibly, stand for *posuit modum*, in the sense of "put an end to," "gave up," and COS for *consulatui*. But I do not recollect having met with a parallel, Or, perhaps, P · M · COS · may stand for *post mensem consulatum*, and the phrase may have been used in accordance with the ordinary *ante diem* (*tertium, &c.,*) *Kalendas, &c.*, where *ante* governs *Kalendas* and *diem* is placed in the accusative, although the context would sometimes require a different case. As to CAPASCAS—if that be the true reading—the only it conjecture, which I can offer, relates to the first two syllables, which, is possible, may be for CAPITARIVS AS, *scil. as* for *tributum, i.e.*, the capitation tax. It is scarcely necessary to say that the *tributum* was of three kinds: *secundum capita, secundum censum*, and *extra ordinem*.

On the whole, I am inclined to suggest as the most probable reading of the principal inscription:—

NERONIS AVG[VSTI] EX K[ALENDIS] IAN[VARIIS]
QVARTVM CO[N]S[VLIS].

It is not improbable that the lateral inscription IVLPMCOS may stand for IVL[IAS] P[OST][M]ENSEM CO[N]SVLATVM and it is possible that CAPAS—of which C · AS may be a repetition in a shorter form—may denote that the block was one of those prepared in payment of the capitation tax, whilst XXX may mark the number of the pig.

# ON THE POSITION OF LIEVRITE IN THE MINERAL SERIES.

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Much uncertainty still prevails regarding the true composition of *Lievrite* or *Ilvaite*. The earlier analyses of this mineral, those of Vauquelin and Collet-Descotils, made the substance, essentially, a silicate of sesquioxide of iron and lime. Stromeyer's analysis, which followed those of the above-named chemists, gave the iron, on the other hand, as protoxide. A subsequent examination by Von Kobell disclosed the presence of both oxides, as fully established by the later analyses of Rammelsberg and others. These analyses, the correctness of which it is impossible to doubt, do not lead however to any general formula; nor can any formula of a satisfactory character, in a mineralogical point of view, be obtained from them. It will be as well to quote their results before proceeding with our inquiry. *A* is Stromeyer's analysis, as calculated by Von Kobell; *B*, that of Rammelsberg; *C*, Wackernagel's; and *D*, Francke's—all of Elba specimens. *E*, is an analysis by E. Tobler, of a specimen from Herbornseelbach in Nassau. (*Ann. Chem. und. Pharm.* xcix. p. 122. Also Rammelsberg's *Mineral-Chemie*, p. 740.)

| | A. | B. | C. | D. | E. |
|---|---|---|---|---|---|
| Silica | 29.28 | 29.83 | 29.45 | 29.61 | 33.30 |
| Sesquioxide of Iron | 23.00 | 22.55 | 25.78 | 21.09 | 22.57 |
| Protoxide of Iron | 31.90 | 32.40 | 28.60 | 32.71 | 24.02 |
| Protoxide of Manganese | 1.43 | 1.50 | 0.94 | 1.55 | 6.78 |
| Lime | 13.78 | 12.44 | 15.49 | 14.47 | 11.68 |
| Alumina | 0.61 | .... | .... | .... | .... |
| Water | 1.27 | 1.60 | .... | .... | 1.12 |
| | 101.27 | 100.32 | 100.25 | 99.43 | 99.47 |

Rammelsberg deduces from the above, the following oxygen ratios, and calculates, from these, the formulæ given below—truly stating, however, at the outset, "es geht hieraus das wahre Verhältniss nicht mit Sicherheit hervor."

RO. $R^2O^3$. $SiO^2$.
*A* ... 11.33 — 6.90 — 15.21 .. = 4.9 : 3 : 6.6 = 9.8 : 6 : 13.2
*B* ... 11.08 — 6.76 — 15.49 .. = 4.9 : 3 : 6.9 = 9.8 : 6 : 13.8
*C* ... 11.01 — 7.74 — 15.29 .. = 4.2 : 3 : 5.9 = 8.4 : 6 : 11.8
*D* ... 11.75 — 6.33 — 15.37 .. = 5.6 : 3 : 7.3 = 11.2 : 6 : 14.6
*E* ... 10.19 — 6.77 — 17.29 .. = 4.5 : 3 : 7.7 = 9.0 : 6 : 15.4

I. .... 5 (2 RO, Si $O^2$) + 2 ($Fe^2O^3$, Si $O^2$). This requires the oxygen ratio, 10 : 6 : 14.

II. .... 3 RO, 2 $Fe^2O^3$ + 6 (RO, Si $O^2$). This assumes the sesquioxide to play an electro-negative part, and requires the oxygen ratio 9 : 6 : 12.

III. .... 2 (2 RO, Si $O^2$) + $Fe^2O^3$, Si $O^2$. This requires the oxygen ratio 4 : 3 : 6.

IV. .... 9 (2 RO, Si $O^2$) + 2 (2 $Fe^2O^3$, 3 Si $O^2$). This exacts the oxygen ratio, 18 : 12 : 30.

Apart from this want of concordance, these formulæ do not serve to connect our mineral with other species of kindred character. In other words, they fail to present any satisfactory indication of the place which the *Lievrite* should occupy amongst the Silicates generally. Reflecting upon this, it occurred to me that the true composition of the mineral might be arrived at by tracing out its mineralogical affinities. If this seem paradoxical, it must be remembered that purely mineralogical considerations have taken the initiative on more than one occasion in the solution of obscure questions connected with mineral chemistry. Whilst, for example, the various garnets, the different varieties of pyroxene, &c., were still kept apart by the chemist who adhered to chemistry alone, Mineralogy insisted upon their union, and thus led the way to the recognition of Isomorphism. If the relationship of *Lievrite* to a mineral of known composition can be clearly shown, a great assistance will at least be afforded towards the deduction of its true atomic character.

On comparing this mineral with other silicates, one cannot help being struck by the remarkable correspondence existing between it and *Chrysolite*—at least, as regards the so-called *Fayalite* and other iron-holding varieties of the latter. It is curious that this coincidence should hitherto have escaped attention. The gelatinization of the silica in acids, a very peculiar character in the case of anhydrous silicates, is exhibited by the two species in common. Their conditions of occurrence are also more or less identical, the form in each is Trimetric with axial relations in part corresponding, and each contains an unusually low average of silica. This amounts, in *Hyalosiderite* and *Fayalite*, to about 30 per cent. The same also in *Lievrite*. Dana places the latter mineral (though doubtfully) in his ANDALUSITE GROUP, with *Andalusite*, *Topaz*, and *Staurolite;* but a collocation of this kind is an exceedingly forced one. Geological relations (an element in Mineralogical Classification of the highest importance, although hitherto strangely overlooked), composition, and general characters, are all opposed to it. The form, it is true, is Trimetric, with some remote analogy, as shewn by Dana, to that of *Andalusite;* but since we find such opposite minerals as *Augite* and *Borax*, for example, exhibiting an identity of crystallization, no great stress can be placed on this character. There is an equal amount of crystallographic correspondence, moreover, between *Lievrite* and *Chrysolite*, whilst in other respects the two present a close agreement. In Chrysolite, several vertical prisms are known (the $\infty P$ series of Naumann and most German crystallographers; $I$ series of Dana; $V$ series of the author. If we make the macrodiagonal unity, these prisms give for the brachydiagonal, the following values:—0·4660 ($= V$; prism-angle, 130°2′);—0·9484 ($= V 2$; prism-angle, 93°3′);—1·397 ($= V 3$; prism-angle, 71°10′);—1·684 ($= V 4$; prism-angle, 61°47′). In Lievrite, the two commonly occurring prisms, give, respectively—0·6840 ($= V$; prism-angle, 111°12′);—and 1·370 ($= V 2$; prism-angle, 72°16′). To make these correspond with the chrysolite values, the first prism must be considered to equal $V \frac{3}{2}$, and the second $V 3$. The vertical axes of the two forms stand to each other very nearly in the ratio of 5 to 4. But we need not attempt to push these analogies beyond their legitimate limits. The affinity, in general characters and conditions of occurrence, of *Lievrite* to *Fayalite* (and through this latter to *Chrysolite*) cannot be overlooked if we take the entire relations of these substances into consideration. Single characters, in the determination of analogies, are necessarily useless.

Now, the atomic constitution of the *Chrysolites* is perfectly well established. The oxygen atoms in base and acid are equal, and the base consists of simple oxides only, the general formula being $2\,(RO), Si\,O^2$; or two atoms of monoxidized base + one atom of Silica. In the normal *Chrysolites* the base consists of magnesia; in the *Olivines*, of magnesia and protoxide of iron; and in *Fayalite* (at least, essentially) of the latter oxide alone. In *Lievrite*, on the other hand, as shewn above, both protoxide and sesquioxide of iron are present; and the oxygen atoms of the Silica do not correspond with those of the bases.

In attempting to reconcile these discrepancies, I called to recollection a fact that came under my notice some time ago. In examining a specimen of *Lievrite* that had been broken up into small pieces, I found that certain fragments exerted a much more powerful influence on the magnet, than others. Whilst some of the particles scarcely shewed a trace of magnetism, others were magnetic in a marked degree. These latter, tested by the blow-pipe, seemed almost free from silica; whilst the feebly-magnetic fragments gave very readily, with microcosmic salt, the well-known reaction of that substance. It occurred to me, therefore, that the analysed specimens of *Lievrite* might have contained a certain portion of magnetic iron ore: a circumstance easily conceivable, if we call to mind the geological associations of our mineral. The nearly uniform proportions of the $Fe\,O$ and $Fe^2O^3$ found in the various analyses, seemed, it is true, opposed to this idea; but it appeared at least possible that the crystallized specimens might be able to take up a certain proportion, and no more, of the magnetic oxide. I calculated therefore from the four first analyses given above, the mean composition of *Lievrite*, and reduced this, with the following results, to 100 parts:—

| | | | |
|---|---|---|---|
| Silica | 29.54 | = | 29.66 |
| Sesquioxide of Iron | 23.08 | = | 23.25 |
| Protoxide of Iron | 31.25 | = | 31.49 |
| Protoxide of Manganese | 1.35 | = | 1.46 |
| Lime | 14.04 | = | 14.14 |
| | 99.26 | | 100.00 |

Now, 23.25 parts of $Fe^2O^3$ require 10.46 parts of FeO to form magnetic iron ore ($= FeO, Fe^2O^3$). This deducted from 31.49, leaves 21.03 for the protoxide of iron present (on the above supposition) in the silicate. The analysis consequently stands as below:—

| | | | |
|---|---|---|---|
| Silica | 29.66 | = | 44.75 |
| Protoxide of Iron | 21.03 | = | 31.72 |
| Protoxide of Manganese | 1.46 | = | 2.20 |
| Lime | 14.14 | = | 21.33 |
| | 66.29 | | 100.00 |

Calculating the oxygen ratios of the above, we obtain:—

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| $SiO^2$ | 23.24 | = | $1\frac{3}{4}$ | = | 7 | = | 14 |
| FeO<br>MnO<br>CaO | 13.59 | = | 1 | = | 4 | = | 8 |

Here, then, we have 8 atoms of RO to 7 atoms of $SiO^2$, in place of 2 to 1 as required by the chrysolite formula. If the oxygen ratios in any of the above analyses had come out as 9 : 6 : 14, we might have written the formula $7 (RO, SiO^2) + 2 (FeO, Fe^2O^3)$; but the analyses do not yield these values. The view, therefore, as suggested above, that the peculiar composition of *Lievrite* may arise from the presence of magnetic iron ore, cannot be sustained.

But the formula of *Lievrite* may be brought to coincide with that of the Chrysolite series, by assuming the iron to have been originally present in the condition of FeO only. If this be assumed—and the assumption is in part warranted by the well-known fact that *Lievrite* is especially subject to alteration, the conversion of the FeO into $Fe^2O^3$ still going on in many specimens—the difficulty is at once removed.

Taking the mean composition as given above, and calculating the weight of FeO corresponding to the 23.25 *p. c.* of $Fe^2O^3$, we obtain 20.92. Adding this to the FeO, and correcting the whole to 100 parts, the analysis reads as follows :—

| | | Oxygen: | |
|---|---|---|---|
| $SiO^2$ | 30.47 | | 15.81 |
| FeO | 53.66 | 11.91 | 16.33 |
| MnO | 1.40 | .31 | |
| CaO | 14.47 | 4.11 | |

Although these values do not come out exactly equal, they lead evidently to the common chrysolite formula 2 (RO), $SiO^2$. If we adopt, consequently, the assumption on which the above calculation is based, the *Lievrite* falls naturally into the mineralogical group to which it undoubtedly belongs; whereas on the other view, founded on the bare results of analysis, not only does the atomic constitution of the mineral remain uncertain, but its composition fails to harmonize with its physical characters and conditions. The suggestion, therefore, embodied in this brief notice, may not be found altogether unworthy of consideration by those engaged in the study of mineral analogies.

## REVIEWS.

*Seven Years' Residence in the Great Deserts of North America.* By the Abbé Em. Domenech, Apostolic Missionary; Canon of Montpellier, Member of the Pontifical Academy, Tibernia, and of the Geographical and Ethnographical Societies of France, &c. Illustrated with fifty-eight wood-cuts, by A. Joliet, three plates of Ancient Indian Music, and a map showing the actual situation of the Indian Tribes, and the country described by the author. 2 vols., 8vo. Longman & Co., London. 1860.

From the days of England's first prose writer and earliest of literary travellers, Sir John Mandeville, the wonders of unknown lands have been an unfailing source of the marvellous. In his time, though the New World was still among the marvels of the future, yet "Tartarie, Persie, Ermonie, Libiye, Chaldee, Etiope, and Ind the Less and More, where dwellen many divers folks, and of divers shapes of men," were all in that pleasant condition of misty obscurity which allowed ample scope for embellishment by a traveller of adequate powers. Still more, the reading public, then, and for a couple of centuries after, was gifted with an amplitude of faith in the compass of the marvellous pertaining to strange lands, which only exposed a traveller to the censures of the incredulous, if he should venture to affirm that he had seen anything among the Antipodes resembling matters at home. In those days a Du Chaillu with his Gorillas and nest-building Troglodites, would have been considered rather tame and common place; and the bookmaker who has spiced up Anderssen's "Okavango River" to the requisite seasoning for Mudie's readers, might have drawn on his fancy as freely as the old romancers, who anticipated in their creations the recovered Saurians of the Geological age of monsters. It is curious, indeed, to note how, with each fresh accession to the area of exploration, the appetite for the marvellous grows with what it feeds on. The discovery of America gave wondrous scope to this; the explorations of the Southern Ocean in the eighteenth century again revived it; Layard in Asia, and Livingstone in Africa, have furnished fresh incentives; and guided by Franklin, Kane, and other recent Arctic voyagers, the northern "regions of thick-ribbed ice" have warmed imaginations into a glow fit to melt the dread barriers of their long-hidden mysteries; until, amid the rivalry of arctic and equatorial exploration, men's minds are divided on the question, whether to look for the new terrestial paradise in undiscovered islands of the "open Polar Sea," or in the unexplored platteau of the African tropics.

In the work named at the head of this article we have a recent production of the European press, which, though professing to be rich in marvellous disclosures about the unknown regions of our own Western hemisphere, has, we suspect, nearly escaped the attention of Canadian readers. We are somewhat doubtful, indeed, whether many of them have a very clear idea as to where our unexplored American Zaharas lie. Such a mystery hangs about them, that seven years' residence in the Great Deserts of this New World ought to be productive of some marvellous revelations; and here we have two portly and elaborately illustrated volumes professedly teeming with such.

When our great dramatist undertook to picture the courtship of the Moor, and the tender, yielding sympathies of Desdemona, it was with no thought of discrediting the veracity of his hero that the poet represented him as calling his wonderful relations a traveller's history :—

"Wherein of antres vast and deserts idle,
Rough quarries, rocks, and hills whose heads touch heaven,
It was his hint to speak; such was his process;
And of the Cannibals that each other eat,
The Anthropophagi, and men whose heads
Do grow beneath their shoulders!"

To hear such very credible things the daughter of the old Venetian senator did seriously incline; and even in the Poet's own day, the world of Columbus, Vespuccio, Cortes, and Pizarro, was so new, strange, and little known, that it only required equally respectable witnesses to prove that the Utopian Commonwealth of Hythloday still flourished there, and that the aborigines' heads did grow beneath their shoulders, instead of between them. For ourselves we live in a time when it behooves us to make the most of our "travellers' tales." Exploration progresses at such a rate that every year lessens that unknown area, within which the Darwinian philosopher may still speculate on the discovery of the transitional authropoid animal in his last stage of passage from apehood to manhood. But with a Mudie's readers, multiplying by the thousands, the question of literary supply and demand becomes scarcely less pressing than that of the cotton supply to England's Manchester Associations; and if we could only furnish writers with the invention of a Defoe or the genius of a Swift, we should be well content to trace out on our maps the voyages of new Robinson Crusoes and Gullivers; and like our fathers, give the preference to the adventures of a Munchausen, rather than to the Abyssinian travels of a Bruce.

Amid such voluminous literature as the seven Essayists have recently given birth to, the charge has been revived against this age of ours that it is a sceptical one; but we demur to any such charge. Now and then a literary adventurer like Du Chaillu, in his haste to meet the sensational demands of the popular press, is hurried beyond reason, and only discovers when too late, that he has crammed in an extra year's travelling into the too precise interval between his A.D. 1856 and 1859. But within all reasonable compass the reading world is still most charitably credulous with its "travellers' histories;" and as to their pictorial adjuncts, so that they please the eye, the standing rule is, "no questions asked." When Messrs. Childs and Peterson, the enterprising New York publishers, issued their beautifully illustrated edition of Dr. Kane's "Arctic Expedition," no critic ventured to inquire if the lamented traveller's sketch-book did actually contain the germs of all its wonderful vignettes of Arctic scenery, sketched in the dread polar midnight, when imagination has to picture the indefatigable draughtsman exposed to a temperature in which the mercury freezes in his thermometer, and manipulating in the dark, with his pencil in a hand gloved and furred, till it was less delicate than a polar bear's paw. The genuineness of the touching narrative no one questioned; and illustrations being in request, the artists of Philadelphia and New York proved equal to the demand, whatever may have been the rude suggestive scraps of pencilling from which they wrought. But even this failed to satisfy the omniverous appetite of a reading public. A second American Arctic narrative followed, and might have commanded as unquestioning a welcome as the first, had not the rogues fallen out over the spoils; and the Philadelphian correspondent of a New York journal given publicity to the quarrel, as the exposure of "a piece of literary swindling worthy of the notorious Barnum." "It is well known," writes this correspondent, "that Dr. Kane's work on the Arctic Expedition was all the rage a short time ago in American society. An engraver named Cyram has lately sued the publishers, Lloyd & Co., of Philadelphia, for the sum of $264, due for engraving plates for Dr. Kane's work. Some amusing facts came out on the trial. It appears that the picture representing the *Advance* stuck in the ice, was copied from an old picture in Captain Cook's Voyages in the Southern Seas, with ice thrown in *ad libitum*. The portrait purporting to be Sontag, one of Kane's officers, was altered from a portrait of a highwayman in the *National Police Gazette*. An engraving representing the occulation of Saturn, was produced by altering an eclipse of the sun from an old geography; and there was more of the same sort. If this is the way Philadelphia publishers bring out the crack books of the season, they deserve to be as world-famous as the Philadelphia lawyers."

These, however, are the doings on this progressive side of the Atlantic, where the ideas of publishing, copyright, and book-begetting all together, have revealed a stage of development unknown to Europe's fossil old stagers. Indeed England has hitherto flattered herself that "Barnum" is quite a distinct and purely American variety of the species; and rather taken comfort from the thought that his grand science of Humbug finds its fitting sphere only in the Great Republic; nor need she be startled out of her self-complacency by the whisper of a Du Chaillu and his Gorillas. The traveller is none of her begetting, but a sort of nondescript, Americanised, African Frenchman, recently adopted and very partially naturalized in England. His publisher, though naturally a little sensitive on the subject, stands acquitted of all culpable share in the Gorilla-book manufactory; and we hope is resigned to the inevitable; finding it by no means a losing concern to have undertaken the publication of so notorious a traveller's tale. The *index expurgatorius* is generally the best of advertisements; though some men are squeamish enough to object to be pilloried, notwithstanding the notoriety it secures.

It is not, however, our purpose to follow in the wake of English and German critics, in reviewing the apochryphal adventures and superabundant chronology of Pierre Beloni Du Chaillu, or other such literary freebooters; but on the contrary, to invite our readers into an exploration of the Great Deserts of the New World, under the guidance of the well-accredited author whose name and credentials figure at the head of this article.

The Abbé Domenech, Titular Canon of Montpellier, and member of the Tibernian Pontifical Academy, as well as of sundry Parisian Scientific Societies, is already known as the author of "Missionary Adventures in Texas and Mexico," a work which all have agreed to praise. The *Eclectic Review* commended its author as one who has transferred to the territories on the banks of the San Antonio and Rio Grande, that interest which the Abbé Huc knew so well how to give to the scenery and life in China. The reviewer does, indeed, confess to earlier doubts that the author was impudently testing the powers of credence of his readers, and drawing on his imagination for the details by means of which a genuine sketch was stuffed out into bibliopolic amplitude. But with some slight reservation he withdraws his earlier incredulity, and accords his praise to the volumes, not as a romance, but as a traveller's narrative. The *Saturday Review* follows with the same readily suggested comparison between the famous Chinese explorer, and this "good and brave young Abbé Domenech," who now in his later volumes, addresses from Paris his dedication, "To his Lordship, Charles Thomas Thibault, Bishop of Montpellier, Roman Count, Assistant at the Pontifical Throne, Commander of the Imperial Order of the Legion of Honour, and of the Religious and Military Order of Saints Maurice and Lazarus, Knight of the Grand Cross of the Honourable Order of Christ of Rome, of the Order of the Holy Sepulchre," &c. &c. There is something refreshing in escaping beyond regions of misty dubiety, within the pale of such well accredited veracity as is certified here. We seem to look in fancy on the good young Abbé, who, enchanted doubtless with the reception his first volumes met with, has been induced, as he tells us in his preface, "to continue the publication of his ethnographical studies, and the precious notes gleaned during his sojourn in the New World, on the nature, the aspect, and the singularity of the American Deserts, as likewise with regard to those savage tribes who are as varied in their physical appearance as they are similar in their civil and religious organization." Were not the many-titled Bishop of Montpellier's authentication of his titular canon's identity abundantly sufficient for the purpose, the Messrs. Longman would no doubt be prepared with their testimonials. So far, however, as the materials wrought up into two portly volumes, out of the Abbé's "precious notes," are concerned, we must confess we should not find it very difficult to believe that their author never travelled beyond the purlieus of Grub Street. The preface led us to expect a tale fit to captivate another Desdemona. "America," says the Abbé, "is comparatively speaking, a new country, a virgin land, which contains numerous secrets." Again he exclaims: "In those wildernesses there are actually to be found hieroglyphical monuments, immense ruins; white, red, and brown Indians; albinos, bearded men, and men without beards;" and then he adds: "This work is but a detailed programme of what I hope to publish gradually on this subject. I have spared neither fatigue nor labour to give my readers an exact idea of the great wildernesses of America, and of the Indian tribes they contain. If *I have not been able to derive much help from the books published by some writers who have treated on this subject*, it is because their accounts are, generally speaking, exclusively confined to the Indians of the United States." Nevertheless, he confesses to having read Schoolcraft and Catlin's works, the publications of the Smithsonian and Ethnographical Societies, and the reports of the United States Scientific Expeditions, "either," as he says, "to generalise my opinions or to complete my narrative."

After such a flourish of trumpets, from an author so rich in the abundance and novelty of his materials, that these two portly volumes constitute the mere programme of what he hopes to publish on the subject: we were surely justified in anticipating the opening up of virgin soil. Instead of this, however, the perusal of these "programme" volumes rewards us only with a stale rifacimento of crude, or exploded ethnological platitudes, and a vague expatiation over all hitherto explored corners of the map of North America, but without a noticeable addition to our knowledge of "parts unknown." Far be it from us to doubt that there actually does exist—in London, Montpellier, Rome, or Texas,—this "good and brave Abbé Domenech;" but it certainly lay within the capacity of an ordinary Grub Street book-hack, to compile quite as good an *omnium gatherum* of extracts from American blue-books, and Scientific Society's publications, without ever travelling beyond his ink-bottle and library shelves. The much-abused Du Chaillu, not only was in Africa, but brings home and sells to Professor Owen, his gorillas, in proof that he did shoot them; in spite of sceptical naturalists who trace his illustrations to Parisian photographs and other handy material. But the explorer of our American Deserts does not, so far as we can discover, furnish a solitary picture of the novel ethnographic or other secrets revealed to his favoured eye in the "Virgin Land" of his exploration.

The volumes are set forth as "illustrated with fifty wood-cuts, by A. Joliet, three plates of ancient Indian music, and a large map shewing the actual situation of the Indian tribes and country described by the author." As for the last of these, it is comprehensive enough to satisfy any definition of the so-called "great deserts of North America," for it is a map of the whole continent from the Hudson's Bay to the Gulf of Mexico, and from the Atlantic to the Pacific Coasts; and well answering in its vagueness to the book itself, which proves to be a weary journey through "Great Deserts" of printed wastes, instead of through actual savage-haunted wildernesses. So far, however, is the map from representing "the actual situation of the Indian tribes," now, or during the supposed travels of the author, that we find the Hurons, for example, on the Georgian Bay, from whence they were driven or extirpated while Canada was still a French Colony; and the Shawnees and other tribes, on Lake Erie, where our Abbé, had he really gone to visit them, would have found only the busy population of their long-settled white supplanters. In truth, though our author does here and there seem for a moment to refer to things seen by himself, it is in so vague and dubious a fashion, and interspersed among so many more he certainly never did see, that but for his previous "missionary adventures in Mexico and Texas," we should have been strongly tempted to enquire after "the good Abbé" among those unpretending men-of-all-work, who cater for the book-manufacturers of Paternoster Row, and pen their veracious chronicles

> "Of most disastrous chances,
> Of moving accidents by flood and field;
> Of hair-breadth 'scapes,"

and all without ever missing the familiar Cockney music of Bow-bells. We say, but for the author's previous adventures. But there are other credentials also, which surely lie beyond the inventive art of the Book-maker, in those fifty-eight showy Zylographs which give such an air of well-authenticated accuracy to the volumes· There are portraits of natives, pictures of strangest scenery, engravings of inscriptions, native implements, pottery, &c., bringing home to our firesides the wonders of the great deserts; or, failing in this, illustrating the latest economic development of free trade in the Grand Art of Book-making.

Our first glance at the Abbé's illustrations suggested a strange familiarity in their choice picturings, such as was scarcely to be expected in his revelations of the mysteries of a "virgin land;" and the result of a little research to which this tempted us, may perhaps help the reader to some idea of the requisite process in the newly developed manufacture, whereby two goodly volumes of fascinating travel may be got up, with the help of a good name, and a reputable dedication, by any one who has access to a moderately furnished library. And first for the ethnology of the volumes. Volume II. figures for its frontispiece, a genuine "Comanche" in highly characteristic attitude, on horseback, and with his long lance in rest upon his left arm. But the original may be seen by any one curious on the subject, in a quarto plate, not of Comanches, but Navajos, drawn by H. B. Mölhausen, the artist of the U. S. Exploring party for a Railway route to the Pacific; Washington, 1855, p. 31. Like most of the other borrowed illustrations, the figure, which is one of a group, is reversed, and the features are so poorly copied as to be worthless for all ethnological purposes. The same Washington Report in like manner supplies the Mojave Indian, introduced at p. 40, vol. II., but still worse drawn, and if possible, more worthless for anything but a child's picture book. At an earlier date there issued from the Washington Bureau certain "Reports of the Secretary of War, with reconnaisances of routes from San Antonio to El Paso," and these, being little likely to come under the eye of ordinary readers, have proved a mine of wealth for our adventurer;—who might aptly exclaim with the stay-at-home author of "The Task,"

> "He travels, and expatiates; as the bee,
> And spreads the honey of his deep research
> At his return,—a rich repast for me;
> *He travels, and I too!*"

In volume II., an account of the "Indians of the Pueblos" occurs, vague and uncircumstantial, as ever second-hand materials were; and with its more defined pictorial illustration to eke out the text. But here again the so called "Pueblo Indian" proves to be a coarse caricature, the reverse of plate IV, of the Washington War Reports of 1850, representing in the original,—not a mere ordinary Indian, but "Hos-ta, or the lightning, governor of the Pueblo of Jémez." On the contrary the so called "Navajo Chief," of the Abbé, appears in pl. LII. of the same War Report, merely as an illustration of Navajo costume; but to fit him for his sudden promotion, a dandified shield with scalp-locks, borrowed from the fashions of the totally diverse tribes of the north, is substituted for the plain oval shield of hide, as originally drawn by R. H. Kern, the draughtsman of the Navajo Expedition. Ridiculous as such incongruous additions appear to any one familiar with the Indians of the north and of the south, they are trifles compared with the *olla podrida* served up, at p. 207, of vol. I., in the plate designated "Inscription Rock." This accompanies a description of the El Moro Rock of the Sierra Madre, one of the most extensive and curious groups of native and early European graven records hitherto discovered on the whole continent. Like most other descriptions from his pen, the reader is left to guess as he best may, whether the author pretends to have seen the objects he thus vaguely describes: "Beyond the Agua Fria you descend the western slope of the Sierra Madre, and reach a very open valley wherein may be seen *the Rock of Inscriptions* called El Moro by the Mexicans;" and so the writer proceeds,—in a diluted version of Lieut. J. H. Simpson, of U. S. Topographical Corps' narrative of his visit to the El Moro in 1849,—to tell, with all the indefiniteness of a borrowed report, what you may, can, might, would, or could see, gentle reader, if you only were there. But as to the accompanying illustration, be certain, if it is ever your fortune to visit the Sierra Madre, you will search in vain for its prototype; though without travelling any such perilous journey, you may discover its materials in the unmentioned volume of Washington War Reports now referred to, from whence there can be little doubt the Abbé has drawn all his knowledge of the Moro Inscriptions. To this conclusion we are led, not only by the fact that the illustrative plate is a patchwork of scraps gleaned from half-a-dozen lithographs appended to Lieut. Simpson's Report, with Spanish inscriptions and Indian hieroglyphics transposed, reversed, and jumbled up together into as pretty a specimen of rock-engraving as the most credulous could desire: but also from another little bit of circumstantial evidence. Chap. XXI. is devoted to the subject of Indian ideography, inscriptions, &c., and with a cool effrontery, which might put Barnum himself out of countenance, our traveller thus comments on the shortcomings of his predecessors: "Thus do those men, prudent travellers, learned from intuition, return home to regale their countrymen with the history of a people they have hardly perceived, and describe places into which they have never ventured to enter; the consequence is that their narratives abound in errors and exaggerations. One cannot be too guarded against writers who invent respecting matters they know nothing about, and who translate while misunderstanding the works already published on the same subject." Having delivered himself with this lofty air, of his opinion of European travellers and their books in general, our author proceeds to illustrate by example his ideas of a more virtuous course, and resumes the subject of the Moro inscriptions, because as he says, they "have never been mentioned in any scientific or geographical work published in Europe." It is, of course, much too trivial a matter for him to condescend to notice, that they have not only been mentioned, but transcribed and illustrated in fac-simile, in Lieut. Simpson's Report. But though, as the latter tells us, they were described to him in what, after personal inspection, he acknowledges to have been no very extravagant hyperbole, as "half an acre of inscriptions," it is a singular coincidence that the Abbé not only does not chance to have noted a single example which his predecessor had not already copied; but where the latter, in transcribing the longest of them, has inadvertently added on to its commencement, the name of "Bartolomé Narrso," which, as appears from the fac-simile, stands apart and entirely distinct from it, the Abbé, by the most unaccountable accident, has fallen into the very same error!

Other inscriptions are from more familiar sources, such as Schoolcraft's "Indian Tribes," the American Ethnological Society's Proceedings, &c., though it is not a little amusing to find the learned

Abbé gravely weighing the rival merits of Lybian, Touranik, or Celtiberian claims for the somewhat notorious hoax of the "Grave Greek inscription;" and with corresponding gravity discussing the claim to a Phœnician origin for the Indian scratchings on the Dighton Rock. But we look in vain for a single original contribution to the old familiar materials illustrative of American lithology or ideography; though the author might just as well, and with as little contempt for truth, have invented for us a good Punic, Iberian, cuneatic or runic inscription, as patched up the jumble he has figured under the name of El Moro rock. What a pity it is that he missed the famous "Holy Stone of Ohio," recently found near Newark, by Mr. D. Wyrick, C. E., under one of the ancient mounds of the Ohio Valley. It is graven in Hebrew, Syriac, Etruscan, and Runic characters, and is regarded by the savans of Newark and Cincinnatti, as affording indisputable proof that under that very mound Moses was buried, and ' no man knoweth his sepulchre *until* this day!"

The thin octavo volume of "Reports of reconnaisances of routes from San Antonio to El Paro," in which the El Moro inscription was first produced, is an official document not likely to come under the notice of ordinary readers, and from which, therefore, an unscrupulous author might be tempted to borrow with little fear of detection; but the "Deserts of North America," with their topography and ethnology, are not always illustrated from such unfamiliar sources. The pen and pencil of Catlin have both been called into requisition, though it is well known, that lively traveller had himself the reputation of sometimes making the most of meagre materials,—as is indeed the fashion with ingenious artists in all ages. A few examples of the author's manner of appropriating others' materials—"Convey the wise it call,"—will best illustrate our meaning. The "Dawta Chief" of the Abbé, for instance (vol. ii. p. 28,) is Catlin's Sioux, Ee-ah-sa-pa, or Black Rock, whom he met and painted at Fort Pierre, at the mouth of Teton River; The "Iroquois" (p. 33,) is a poor reversed copy of Catlin's Not-o-way, or the Thinker; the "Mandan Chief," (p. 36)—of whom more anon,—— is Mah-to-toh-pa, or the Four Bears, second Chief of the Mandans, though with scarcely a trace of the true Indian features characteristically rendered by Catlin; and the "Saliskas," at (p. 36,) is Stu-mich-o-sucks, or the Buffalo's back fat, head chief of the Blackfeet, painted by the

American artist during his residence at the United States Fort, near the junction of the Yellow Stone with the Missouri.

Unacknowledged appropriations are carried on throughout in the same free wholesale fashion. But the sense of deception practised on the reader, is fully developed when on comparing the Abbé's illustration of an Osage Indian, with Catlin's portrait of Tchong-tas-sab-bee, or the Black Dog of the Osages, from which it is unmistakeably borrowed, not only do we find the characteristic Indian features lost in the surreptitious copy ; but a ridiculous tatooing of two crossed hatchets on the cheek, with sundry other figures on breast and arms, are introduced, not only without authority from Catlin's original, but with as much propriety as an Indian brave's war-paint and scalp-locks would present, if added to the portraiture of General Beauregard, or President Lincoln. The like theatrical additions are introduced on the "Chinook woman," (p. 16, vol. I.) a Flathead Indian, copied, or rather made up, from an inaccurate design, in which Catlin has blunderingly represented the head of the cradle-board, intended to protect the infant from injury, as the instrument employed in flattening its forehead. The truth is, that the original artist, Mr. George Catlin, was drawing on his imagination when he undertook to delineate a Flathead of the Pacific, as he honestly confesses. The latter's description of this flight of fancy begins as follows: "Whilst I am thus taking a hasty glance of the tribes on the Atlantic coast, on the borders of Mexico, and the confines of Canada, the reader will pardon me for taking him a few minutes to the mouth of the Columbia on the Pacific coast, *which place I have not yet quite reached myself*." One of the best proofs of Catlin's general accuracy is the difference between this slovenly fancy sketch and his specimens of genuine Indian portraiture. No one who studies M. Domenech's meagre and inaccurate notice of the Flathead Indians of the Columbia River, will doubt that he would have done well if he had imitated the candour of Catlin. Instead of this, however, the learned Parisian ethnologist treats us and his brother savans to an illustration manufactured by M. Joliet,—or whoever is responsible for the Abbé's pictorial ethnology,—out of the imperfect fancy sketch invented by the American painter.

It is scarcely necessary to follow out our process of comparison further in this department. The whole is made up after the same fashion. The "Chippeway," (vol. ii. p. 18,) is Catlin's *Ka-be-mub-*

*be*, plate 242, with the absurd substitution of a feathered crozier—unknown among Indian implements, lay or sacerdotal,—in lieu of the simple spear in the hand of the original. So also the "Medicine Man," (vol. ii. p. 286,) produced by the Abbé to illustrate a few of his vague common-places, is a feeble copy of Catlin's spirited sketch accompanying an equally graphic picturing of wild Indian life, which he thus introduces: "Sit still then, until I relate a scene of a tragic, and yet of the most grotesque character, which took place in this Fort, (at the mouth of the Yellow Stone River) and *to all of which I was an eye-witness*." He accordingly proceeds to narrate a scene of Indian treachery and revenge, in which one of the Chiefs of the Blackfeet was shot by a Knisteneau. We give his account of it in a condensed form:—

> "The Blackfeet returned into the Fort, and then I saw, what I never before saw in my life,—a medicine man performing his mysteries over a dying man. He was lying on the ground in the agonies of death, and no one could indulge the slightest hope of his recovery; yet the medicine man must needs be called, and hocus pocus applied as the *dernier resort*, when all drugs and specifics were useless. Several hundred spectators, including Indians and traders, were assembled. We were required to form a ring, leaving a space of some thirty or forty feet in diameter around the dying man, in which the doctor could perform his wonderful operations. This being done, in a few moments his arrival was announced by the death-like 'hush—sh—' through the crowd; and nothing was to be heard save the light and casual tinkling of the rattles upon his dress, which was scarcely perceptible to the ear, as he cautiously and slowly moved through the avenue left for him, which at length brought him in view of the pitible object over whom his mysteries were to be performed. He approached in a crouching position with a slow and tilting step;—his body and head were entirely covered with the skin of a yellow bear, the head of which (his own being inside of it), served as a mask. The huge claws also dangled at his wrists and ankles. In one hand he shook a frightful rattle, and in the other brandishing his medicine-spear or magic wand; to the rattling din and discord of all which, he added the wild and startling jumps and yelps of the Indian, and the horrid and appalling grunts, and snarls, and growls of the grizzly bear, in ejaculatory and guttural incantations to the Good and Bad Spirits, in behalf of his patient, who was rolling and groaning in the agonies of death, whilst he was dancing around him, jumping over him, pawing him about, and rolling him in every direction. In this wise, this strange operation proceeded for half an hour, until the man died; and the medicine man danced off to his quarters, and packed up, tied, and secured from the sight of the world, his mystery dress and equipments." Catlin adds, "There are some instances, of course, where the exhausted patient unaccountably recovers; and in such cases this ingenious son of the Indian Esculapius will be seen for several days after, on the top of a wigwam,

with his right arm extended and waving over the gaping crowd, to whom he is vaunting forth, without modesty, the surprising skill he has acquired in his art, and the undoubted efficacy of his medicine or mystery."

Such, in a greatly condensed form, is the American artist's lively narrative of his first sight of a native medicine-man of the Blackfeet Indians on the Yellow Stone River.

By one of the curious coincidences so frequent in his work, the Abbé Domenech gives, as pictorial illustration, the very Blackfoot Medicine Man sketched by Catlin under the circumstances narrated above; but in lieu of his graphic and circumstantial details, we have only some vapid generalities about "The Doctor-magician-priests," after which our author thus proceeds: "The dress they wear seems the effort of an imagination in delirium. We shall describe the one which to us appeared the most extraordinary. The science of the doctor in question was in great renown among the Indians, (what Indians?) and his *costume de circonstance* equally well-known among the pale-faces;" and so he goes on, describing the very same Yellow Bear skin dress; which, as Catlin exhibited it both in Paris and London, it is very possible he did see, and think "the most extraordinary."

We have said enough to show the value of our author's contributions for behoof of his brother members of the Ethnographical Society of France. The Parisian savans must be equally delighted with his archæological and topographical novelties from the New World. The landscapes are copied, or rather "made up," from similar sources to those already noted as laid under contribution. The "Natural Hill," for example, as it is somewhat oddly designated, is a slovenly copy of "Pyramid Mountain in the Valley Laguna Colorado," figured from a careful drawing in the "Report of the Geology of the Route explored by Lieut. A. W. Whipple, of the U. S. Topographical Engineers," printed at Washington in 1856; and the others are cribbed in like fashion, without acknowledgment. The Indian relics have been dug up out of previous publications with the same honest and naive perseverance. The plate of "Ancient Pipes," (vol. i. p. 392) is culled from the well-known "Smithsonian" volume of Messrs. Squire and Davis's "Ancient Monuments of the Mississippi Valley," from whence also are borrowed the plates of Ancient Pottery, but all printed of a uniform brick-red, in happy indifference to the texture of the originals, of sand-stone, porphyry, yellow clay, &c. The calumet and pipes figured at p. 272, vol. ii., may also be recognised in plate 95 of Catlin's "North American Indians." Schoolcraft's well-known "History of the Indian Tribes," furnishes sundry plates of Indian weapons, implements, hieroglyphs, &c. The American Ethnological Society's transactions have been laid under contribution with equal freedom: and we shall only add that if a single one of all the numerous illustrations is original,—which we more than doubt,—unless it has been drawn in a very different fashion from the slovenly, untruthful copies we have compared with their unacknowledged originals, it must be equally worthless.

The literary part of the book is managed with a little more skill than the clumsy scissors-and-paste work of its pictorial decorations; and if the author really wrote his original in French, the double process of translation borrowed materials must have undergone, would confer on them a novel strangeness which the pencil of M. Joliet has failed to give to the ethnographical illustrations. The facts and arguments, in much the same sequence, may frequently be recognised in the volumes from whence artistic tribute has been so freely levied, but all specialities are for the most part so carefully avoided, that their writers might be puzzled to prove ownership of the borrowed plumes; or establish a parentage for the changeling. Our author, moreover, adroitly leaves the reader to assume that he is writing of what he actually saw in "The Great Desert;" and yet when we attempt strictly to analyse the words, it is apparent that he is not without a loophole by which to escape from the charge of misrepresentation, if it should leak out that all the journeyings of this highly accredited Abbé have been limited to the well-trodden trail between Grub Street and the Row; with perchance an occasional exploration in the fertile regions of Great Russell Street. Here, for example, is one of his stories,—more precise and definite than most,—illustrative of the cold-blooded atrocity of Indian revenge:—

> "A Mandan chief, Mahtotopa, whose portrait may be seen at the Museum of Natural History in Paris, found one day near the village the body of his brother pierced by a lance, which the murderer had left in the wound. He swore to revenge his kinsman, took the lance covered with blood, and carried it to the village, where it was recognised as belonging to Ononyatop, one of the bravest of the Riccaree warriors. The Mandan chief took the Riccaree weapon in his hands, and brandished it over his head before each cabin of the village, declaring in a loud voice that he would kill Ononyatop with the very same weapon. He waited in vain during four years for the opportunity of accomplishing his

design. At last, no longer able to restrain his impatience, he took the lance, saying that the blood of his brother cried out for vengeance, and added: Let no Mandan speak any more the name of Mahtotopa; let no one ask where he is, nor whither he has gone, until you hear the war-cry before your village, and he shows you the scalp of Ononyatop. The iron of this lance shall drink the blood of Ononyatop, or the shade of Mahtotopa shall follow that of his brother. He departed and traversed a distance of more than two hundred miles, with no other provisions than a little maize in a bag, walking by night and hiding by day, for fear of surprise. When he reached the village of the Riccarees he prowled around the cabins for some time, and under cover of the darkness of night approached that of Ononyatop. He saw his enemy light his pipe and lie down. Mahtotopa then entered resolutely and sat down near the fire, over which a kettle full of meat was suspended. He began to eat with the voracity of a man dying of hunger; he then in his turn lighted the pipe which his enemy had laid down after having used it. The wife of Ononyatop, who had also gone to bed, asked her husband who that man was eating in their cabin. The Riccaree answered: 'What does it matter? he is hungry, let him eat.' Mahtotopa then, turning round gradually, in order the better to see the posture of his victim, rapidly seized the lance and plunged it in his heart, took off his scalp in an instant, and as swift as an arrow fled into the prairie, holding his trophy in his hand. The whole village was quickly on foot, but no one knew who had killed the chief Ononyatop; and Mahtotopa, after having run several days and nights, praying the Great Spirit to give courage to his heart and strength to his legs, arrived the sixth day at his native village broken down with fatigue, but happy and proud to have revenged his brother, and to have brought home the scalp of Ononyatop."

Such is the story of Mahtotopa's revenge. Far be it from us to dispute the authenticating proof, that the Mandan chief's portrait "may be seen at the museum of Natural History in Paris;" but, after the extensive use made of George Catlin's pictures, it cannot fail to strike the reader as a curious coincidence, that that artist narrates the very same story, in his twenty-first letter, in illustration of the painted Buffalo-robe of *Mah-to-toh-pa;* a poor travestie of whose portrait by Catlin figures at another page of the Abbé's volumes, with no reference to any Parisian portrait, or Indian story, but merely the indefinite title of a "Mandan Chief."

Schoolcraft has been laid under still larger contributions than Catlin, unless the theory of accidental coincidences suffice to account for unacknowledged resemblances, such as those already referred to. In some cases, however, the Abbé does admit, in general terms, a little borrowing, as where he says, (vol. ii. p. 432,) "Several authors relate a legend which is current among a number of the Northern populations regarding the Island of the Blessed," and he accordingly reproduces an Indian Legend which Longfellow years ago interwove into his "Song of Hiawatha." The comments which this legend elicits are among the most genuine-looking passages of the volumes, though we have read the like before. Let us extract one passage however, as possibly a genuine specimen of the author's own.

> "By such legends have the Indians sought to embellish the doctrine of rewards, and to give it all the power and all the attraction for imaginations as vivid as those of the Red Men, which would have been wanting in an arbitrary law. It is for the same reason that Catholicism makes so much progress among the populations of the Great Deserts, whilst Protestantism, which rests more on the spirit of analysis than on the feelings of the heart, makes but few proselytes among these impressionable people. On several occasions the Indian tribes have written to the President of the United States, begging him to send them ministers of the Great Spirit, of the same religion as those who christianised their ancestors, to teach them how best to serve the Supreme Being, and to instruct them in the manner of cultivating the earth. Many of the Missions founded by the Jesuit fathers in the seventeenth century in the north of America still exist, or have been established anew; that of the Ottawa, on Lake Michigan, is without question one of the most interesting, and the Indians have built a very pretty chapel there.
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> "Amoug the tribes formerly visited by the French missionaries, the recollection of the *black gowns* is very fresh in the minds of the savages. They believe that the true ministers of the Great Spirit have black gowns, and they have but little sympathy with the married priests of the American sects. The number of Catholics is, in fact, very considerable among the Indians of the United States and of the Great Deserts. Dacotas and Osages have been seen trying to make the sign of the cross with the left hand, because it was nearer the heart than the right. The catholicism of the Indians possesses all the absolute simplicity and the robust faith peculiar to unspoiled natures."

The subject thus referred to by the Abbé towards the close, with a tone of genuine sincerity little apparent elsewhere, is one well deserving of greater attention than it appears to receive. Without pretending to any such explorations as would enable us to talk with familiar nonchalance of the secrets of the Great Deserts of America from the Hudson's Bay to the Gulf of Mexico, we know somewhat of the Red Indian in his native haunts. We have seen the poor remnant of the Hurons, in their little chapel of our lady of Loretto on the banks of the St. Charles, and watched the half-breed trapper kneeling in the picturesque sanctuary of Tadoussac, where, under the favour of Henry IV., the merchants of Dieppe and Rochelle established their first trading-post near the mouth of the Saguenay, in 1599; and some two thousand miles westward,—where the enterprise of the Recollet and Jesuit missionaries preceded the earliest traders in the exploration of the great Lakes,—we have watched a band of Chippewa squaws decorating with flowers and birch-bark beadwork, the altar of the little Indian Chapel at La Point, on Lake Superior; ever and anon kneeling reverently before the homely looking stucco figures of the Virgin and Child, as they there made ready for the celebration of one of the Church's high festivals. We have heard the psalm tune raised by an old Mohawk chief, in the Episcopalian chapel of Tuscarora, on the Grand River; seen the Missassaguas gathering for the service of their Baptist Missionary at Rice Lake; and followed the Saulteaux canoes as they dispersed from a Methodist Indian Camp Meeting, among the Islands of St. Marie's River. Christianity in some sort has been brought to bear on the Red Indian of these northern regions of the new world for some two-and-a-half centuries. In this work the French missionaries took the lead; and without forgetting the memorable achievements of John Elliot and the devoted labours of David Brainard, we are bound to express our conviction that the Roman Catholic missionary has been greatly more successful in making converts after his fashion, than the protestant teacher. In part, at least this is accounted for by the adaptability of the showy externals of his worship to the Indian mind. It is a species of object-teaching which appeals to the acutest senses of the Indian, instead of making demands on his inert reasoning powers. In part also it may be ascribed, without prejudice, to the less exacting requirements of the proselytising teacher. A compliance with periodical forms and ceremonies, and the rendering devout homage to visible objects of mysterious sanctity, is in full accordance with all the rude conceptions of religion in the savage mind. But certainly a "robust faith," such as the Abbè Domenech assigns to Indian Catholicism is about the last definition we should apply to the religion of the native convert. "It is true we have three very good Spanish Gods," was, as the Mexican traveller, Bullock, tells us, the remark of a native Mexican, on seeing some of the idols of his ancestors dug up on the site of the Teocalli overthrown by Cortes more than two centuries before; "but," he added, "they might still have allowed us to keep a few of those of our fathers;" and it is an undoubted fact that among many nominal converts both of Catholic and Protestant teaching, the gods of their ancestors are still the objects of their most genuine worship.

It is worthy of consideration whether the protestant missionary might not learn a useful lesson from the catholic, and apply the system of "object lessons" to the perceptive faculties of the rude Indian, without making such the mere source of an external conformity to superstitious observances. The Roman Catholic missionary identifies himself with his converts. The festivals of Easter and Christmas, the fasts of passion week, and other commemorative services come in the place of pagan spring and harvest festivals, and sacred commemorations of their dead. The priest among the half-breed Buffalo hunters of the Red River, accompanies the band to the open prairie, and celebrates mass, before they start in pursuit of the herd; as on the Ottawa the trappers long attended mass at St. Marie's altar, before setting out on their adventurous chase. We fear that too many of our protestant missionaries would think it savoured of paganism to ask a blessing on the forthcoming Buffalo hunt, or the fishing at the Salmon-leap, though the very existence of the tribe during the winter depends on their success. But when such feelings are carried to excess, we cannot wonder at the greater favour entertained for the priest, who identifies himself thus with the daily life of the people, and "becomes all things to all men," after the fashion of his church in every age. The paganism of ancient Rome has transmitted relics of its popular festivals in not a few picturesque rites surviving in modern Italy, as in the annual service of St. Anthony's day, when all the cattle present themselves to receive the papal blessing.

Yet, while thus indicating how the heart of the poor pagan is won, in a way that the less pliant exactions of protestantism are incapable of; let us not do injustice to the self-denying labours and fearless enterprise of the old Jesuit Missionary Fathers. In 1632, Paul le Jeune, "the father of Jesuit Missions," set out with another missionary, in a ship of their own, to the work of evangelizing Canada; but already the Récollet fathers had been before them to Lake Nipissing and Huron itself; and long before the adventurous hunter had penetrated the western wilds, Father Hennepin had listened to the roar of Niagara, and Marquette had sailed on the bosom of the Mississippi. Nor were those fearless pioneers unmindful of their sacred mission. Before the middle of the seventeenth century they had baptized thousands of the fierce Hurons, gathering their converts into villages, instructing them in agriculture and other civilizing arts, and weaning them from their savage atrocities. In 1648, the good father

Daniel perished amid a band of his Indian converts, massacred by the pagan Iroquois; and many successive martyr missionaries suffered at the stake, or were put to frightful tortures, while engaged in their self-denying labours. When at length a miserable remnant of the Huron nation alone survived the exterminating warfare of their ferocious enemies, they were gathered together by the missionary priests, and settled in the neighbourhood of Quebec, where their descendants of mixed blood still survive. But our modern "missionary," the Abbé Domenech, in his "Map showing *the actual situation* of the Indian tribes and the country described," represents the Hurons as still in occupation of the region, from whence the last of them disappeared while the Cardinal Richelieu still ruled the destinies of France and her colonies. Had our Abbé actually visited the country of the savage Hurons, he would have done so in a comfortable railway car, and handed his well-furnished valise to mine host's baggage-porter; in which case he might have questioned the propriety of including it within any one of his "great deserts."

"The Red Men are melting like snow before the sun," was the touching simile of a Miami orator. Whole nations have been utterly exterminated, and the last remnants of others are rapidly following in their wake. Yet still the aborigines assert their claim to a broad and ample domain. Amid all the fictitious romance associated with the name of the Red Indian, we fear that neither Canadian philanthropists nor British Christians are fully alive to their claims on us, or to the numbers still surviving to advance such claims. If we assert the indisputable rights of conquerors and colonists, to our American possessions, do these rights involve no corresponding duties? In the United States, including the Confederate Southerners, with Texas and New Mexico, the Indians number about 500,000; in and around the settled British Provinces they cannot be less than 10,000; and throughout British North America, exclusive of the Esquimaux, they have been estimated at 125,000. On these great numbers (apart from those of Mexico, Central and Southern America,) Christianity and civilization have been equally inoperative. The great mass is still pagan; and what is surely a grave reproach to the British nation and her colonies, this statement applies with full force to many tribes long settled and surrounded by a white population; who regard with a contemptuous indifference, the dissipated, idle, improvident descendant of the old savage hunter and warrior of the forest.

So recently as 1857, the Church of England Missionaries among the Six Nations (the loyalist Indians who accompanied the English refugees to Canada at the close of the American War), replied to the query of the Indian commissioners: "What number are still pagans?" *Ans.*—"A large majority of the Cayugas, and a part of the Onondagas and Senecas;" and similar answers indicate a like condition among other settled tribes. The missions in more than one locality, and especially among the populous islands of Lake Huron, have been discredited by unseemly controversies between Church of England and other Missionaries, while the Roman Catholic Church embraces the greater number of the Indian converts. Meanwhile, impartial observers are tempted to ask in what respects many of such "Christian Indians" present any favourable elements of comparison with the wild Pagan tribes? To this pertinent query, Sir Francis B. Head furnished a tolerably plain-spoken answer in one of the most singular documents addressed by him to the Home Government during his official residence in Canada. Writing to Lord [illegible]lg in 1836, he says: "If we attempt to christianize the Indians, and for that sacred object congregate them in villages of substantial log-houses, lovely and beautiful as such a theory appears, it is an undeniable fact, to which unhesitatingly I add my humble testimony, that as soon as the hunting season commences, the men (from warm clothing and warm houses, having lost their hardihood) perish, or rather rot, in numbers, by consumption. While as regards their women, it is impossible for any accurate observer to refrain from remarking, that civilization, in spite of the pure, honest, and unremitting zeal of our missionaries, by some accursed process, has blanched their babies' faces. In short, our philanthropy, like our friendship, has failed in its professions. Producing deaths by consumption, it has more than decimated its followers; and under pretence of eradicating from the female heart the errors of a Pagan creed, it has implanted in their stead the germs of Christian guilt."

On all this, it must be confessed, the colonist looks with wondrous apathy. The miserable, dirty, semi-civilized Indian who haunts the outskirts of the clearings, has no more romance about him in the eyes of the settler, than the straggling remnants of the forest, which he clears away as an encumbrance to the land. Familiarity speedily breeds contempt, and it seems in vain to hope for any enthusiastic efforts on his part in the evangelization of the Indian. But the element of romance is not without its influence on others besides the colonist. With how different an eye do the annual May gatherings at Exeter Hall and elsewhere, look on a Missionary from some far away South Sea Island or African Kraal, and on a "City Missionary" from the deserts of St. Giles' or Whitechapel! It is hard to believe that the word *Missionary* can be the same in both cases. This may perhaps help to open the eyes of some English philanthropists, to causes which render their self-denying exertions nearly fruitless. The Church of England annually spends, on the Missions in Rupert's Land alone, between £6,000 and £7,000; and in a recent report it is shewn, that besides what is contributed by the Society for the propagation of the Gospel, the Church Missionary Society has expended about £50,000 upon Missionary operations in the Hudson's Bay Territories, in addition to funds contributed by the great Fur Company for the ministrations of religion. The present Bishop of Rupert's Land is a devoted and indefatigable missionary; but the fruits of all this cost and labour, so far as the natives are concerned, seem to be wonderfully small. Perhaps some part of the cause of this is revealed in the pertinent question which occurs in the "Red River Explorations' Report," printed by order of the Canadian Parliament in 1858:—"Can the ministrations of the Church in the English tongue, to orderly resident congregations of European Canadians, or half-breed origin, be Missionary labour, in the sense in which that highest of all duties is understood by those who seek to spread the truths of Christianity among a most degraded and barbarous heathen race?" "On two Sundays during my stay," says Professor Hind, in the same report, "at the time when Divine Service was being celebrated in all the churches of the settlement the heathen Indians held their dog feasts and medicine dances on the open plain. In one instance, five dogs were slaughtered, cooked, and devoured; in another instance, three;—the evil spirit was invoked, the conjuror's arts used to inspire his savage spectators with awe, and all the revolting ceremonies belonging to the most degraded heathen superstition practised, within a mile and-a-half of the spot where the stones are now gathered for the Bishop of Rupert's Land's Cathedral."

We are reluctant to believe that the fate which has hitherto befallen the Red Indian is the inevitable doom of the thousands that still survive. Civilization has elevated tribes as savage, and seemingly even more degraded; and christianity has achieved triumphs not less hopeless in anticipation. To visit a genuine congregation of civilized Indian converts is a very pleasant thing. The sacred music is specially acceptable to them, and they learn to sing in parts, with great sweetness and fervour ; as well as to play on the organ, and other instruments. Without cheating them with a mere round of formal observances in the name of religion ; much may be done to adapt the services of Christian worship to their simple and child-like minds, and wherever this has been effectually done, the change produced is well calculated to gratify the disinterested and self-denying labourer in so good a cause.

The venerable, though little-known Society, "The Company for the propagation of the Gospel in New England, and the parts adjacent in America," nurses anciently accumulated funds and endowments, in some quiet nook of the British metropolis, and supports missionary agents, seemingly, in a very Catholic fashion, among the Indians of Canada ; as it selects them indiscriminately from various denominations. The Hudson's Bay Company, with what some will consider greater catholicity, contributes towards the support of an Episcopalian, Presbyterian, and Roman Catholic ministry alike ; but as might be expected, the services of such are rather rendered to the wealthy residents, the retired Hudson's Bay factors, the merchants, traders, and farmers, white and half-breed, than among the wild Crees, Chippewas, and Blackfeet, by whom they are surrounded.

The interest which justly attaches to the present condition and future prospects of the aborigines of this continent, and the responsibilities which devolve on ourselves as Canadians, in our relations to the dismembered Indian nationalities already retreating before our encroaching clearings, have tempted us to follow the lead of the Abbé Domenech in reference to the traces of any ameliorating influences resulting to what he calls "the population of the Great Deserts." But we must not allow this to divert us from the curious illustration of the process of book manufactory which his volumes afford. The establishment of a new system of book-circulating libraries by Mudie and other enterprising London booksellers is, we fear, doing in some degree for English literature what the cheap pirating-press of the United States has done for the American author. Substantial works of genuine interest and worth are at a discount, while the sensation literature of a Du Chaillu doubles its circulation by the very notoriety which the author's knavery begets for it. No wonder that under such a system new American and other travels should be made without the trouble of crossing the Atlantic.

Messrs. Murray, Longman, and other magnates of "the Row," would be justly indignant at any insinuation of complicity with those light-fingered gentry of the quill, who are ready to figure in Mudie's newest list, as travellers, voyagers, missionaries or scientific Abbés, according to the paramount taste of the day. But will the character of the most reputable of British publishers long shield them from suspicion of at least avoiding any troublesome inquisitiveness about the genuineness of a saleable book? If the gentlemen of Lombard Street innocently give currency to a forged bill, it is returned on their hands when detected, and they refund the misgotten gains; but when the gentlemen of the Row have a literary forgery traced back to them, the chances are that it is with a view to an extra edition and double profits! When virtue is so clearly left to be its own reward, it is not difficult to surmise its fate. Perhaps even in our own small way, we may contribute to the reputation of unappreciated genius, and the public may read in a second edition the same fine moral poem of the Parisian Abbé's "Seven Years' Residence in the Great Deserts of North America," which so modestly contrasts his own veracious labours and accurate science with "the stumbling-blocks of fiction" set forth by other authors. "It is with sentiments of the most lively satisfaction," says he, "that we perceive of late years that authors of talent, scorning low novel writing, the reading of which is so pernicious to sensitive minds, have resuscitated a style of literature full of charm, interest, and novelty, by going to glean their scenes and subjects in the solitudes of the New World. We join with all our heart in this literary movement, which is capable of drawing the attention of the civilized world on those poor savages, to whose well-being we had devoted our youth. This work contains the result of our personal observations, and of our ethnographical studies on the Indians of the Great Deserts of North America; and *we cherish the fond hope that it may be the means of guarding those who may consult it against the stumbling-blocks of fiction, that would make them fall into historical or topographical errors, so very excusable after all, when relating to such important questions, and to regions almost unexplored.*"

Well done, Monsieur l'Abbé! who can wonder that the wise men of the Row were captivated with a book which opens with such apposite morality, and winds up with a touching peroration on the power of religion, and the labours of its missionaries, in contending with the elements of Indian dissolution. No wonder, moreover, that the shrewdest of London's bibliôpoles should have been deceived into sharing such profitable romancing, when it is considered how this same learned Abbé Domenech has since culminated in his literary triumphs. Bent on the fulfilment of his promises of further revelations, he has secured the Emperor Napoleon III. as his latest publisher, and has issued, at Imperial cost, a magnificent folio of hieroglyphic and demotic chroniclings of the New World; as gratifying, we doubt not, to the members of the *Académie des inscriptions et belles-lettres* as the ethnology we have described must have proved to be to his fellow-members of the Parisian Ethnographic Society: for on inspection, this gorgeous imperial folio of Indian hieroglyphics turns out to be a series of facsimiles of a German child's drawing-book, be-sketched and be-scribbled in the usual style of nursery art, which some rogue has palmed on the credulous Abbé as a genuine Red Indian M.S., more valuable than all the contents of Lord Kingsborough's costly folios of Mexican picture-writing.

D. W.

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*New Species of Lower Silurian Fossils.* By E. Billings, F.G.S. (Montreal: November 21, 1861).

In this pamphlet, recently issued by the able palæontologist of the Geological Survey of Canada, the author describes and figures a very considerable number of new fossils from the Potsdam Group and some of the succeeding formations of the Lower Silurian strata. Until a comparatively recent period, the lowest subdivision of our fossiliferous rocks bore the name of the *Potsdam Sandstone*, and was looked upon as consisting wholly of arenaceous deposits, nearly destitute of organic remains—a few fucoids, including the doubtful *scolithus linearis*, some lingulæ, and the celebrated crustacean(?) tracks, making up the entire list of these. The subdivision in question is now known, however, to include also various beds of limestone with interstratified and underlying shales and dark slates, classed collectively under the name of the Potsdam Group, and referred to the horizon of Barrande's Primordial Zone. Whilst the sandstones, as in most strata, are but sparingly fossiliferous, the limestones, with their interstratified argillaceous beds, exhibit an unexpected abundance of organic forms. Amongst those now described by Mr. Billings, several are referred to new genera. The limestone of Anse au Loup on the north shore of the Straits of Belle Isle, has furnished two peculiar corals (or sponges) somewhat resembling *petraia* or *zaphrentis,* but considered by Mr. Billings to belong to a distinct genus, which he names *Archeocyathus.* The form is turbinate, simple or aggregate; the cup deep, and composed apparently of two walls with connecting radiating lamellæ, between which, poriferous tissue is distributed. The inner wall, according to Mr. Billings, appears to have been traversed by pores, affording a communication between the inside of the cup and the spaces filled with the interseptal tissue. One of the species is named *A. Atlanticus,* the other *A. Minganensis.* The latter passes upwards into the calciferous group, and is the form previously described by the author (from internal casts) as a *petraia.* Amongst the Brachiopods, which include species of *Obolus, Orthis, Orthisina,* and *Camerella,* there is also a newly-determined genus. On this, Mr. Billing bestows the name of *Obolella,* from its relationship to *Obolus.* In the latter, the smaller ends of the central pair of muscular impressions belonging to the ventral valve are directed downwards and towards each other, whilst in Obolella, according to Mr. Billings, the reverse of this occurs. The shell is of the ordinary calcareous character,and does not exhibit the dark lustrous appearance common to most species of *Obolus.* Two species are enumerated; but one of these, *O. cingulata,* from Anse au Loup, and from Swanton, Vermont, Mr. Billings considers may be still generically distinct.

The trilobites of these Potsdam rocks are more especially interesting. In addition to the much discussed *Paradoxides,* first discovered in the Potsdam beds of Vermont, and of which examples have since been found at Anse au Loup, Mr. Billings describes no less than five species of the genus *Conocephalites,* and two belonging to *Bathyurus.* The first of these genera, it is now well-known, is eminently characteristic of the Primordial Zone of Europe. The occurrence of the *Paradoxides* or *Oleni* at the distant locality of Anse au Loup, is a fact of much importance in settling the true position of the Vermont strata. Their discovery is due to Mr. Richardson, of the Geological Survey, who has traced out on the north shore of the Straits of Belle Isle a complete sequence of the lower fossiliferous beds.

At the close of this publication, descriptions are given of some new fossils from the Calciferous, Chazy, Black River, and Trenton formations. The more important of these comprise several sponges, referred respectively to the genus *Astylospongia* of Ferdinand Rœmer, and to a new genus named *Eospongia* by the author. These forms are the more interesting, since undoubted examples of fossil sponges do not appear to have been previously recognized in the Palæozoic deposits of Canada. Another interesting form, described in this memoir, is a species of *Ampyx*, of which some fragmentary examples have been discovered in the Chazy limestone of St. Dominique, in the County of Yamaska, and also in the same formation at Highgate Springs in Vermont. E. J. C.

*First Biennial Report of the Progress of the Geological Survey of Michigan, embracing Observations on the Geology, Zoology, and Botany of the Lower Peninsula.* Published by Authority: Lansing, 1861.

This very creditable Report forms an octavo volume of four hundred pages. Its contents emanate almost wholly from the State Geologist, Professor A. Winchell of Ann Arbor; but a subordinate Report on the Zoology of the district embraced within the exploration, is furnished by M. Miles; and an account of the Botany of the region is also contributed by N. H. Winchell. As the northern portion of Michigan has been explored and reported upon by several trustworthy geologists, amongst whom we may mention more especially Messrs. Whitney and Foster, and also the late Dr. Houghton (drowned during the prosecution of the survey off Eagle River, Lake Superior), the attention of Professor Winchell has been directed in this instance to the more southern districts of the peninsula. In his present Report, after a systematic and very able review of the general geology of Michigan, including the connection of its various formations with those of surrounding districts, a detailed analysis of the salt wells, iron ores, coal, and other economic products of the State, is entered into. Some useful tables of altitudes are also given.

The central portion of the peninsula of Michigan is occupied by Carboniferous rocks, around which the older strata successively crop out, presenting the basin-shaped form of arrangement so common in Carboniferous districts generally. In addition to several exposures of granitic rock (probably of Azoic age), together with the trappean formations of Lake Superior, the following series of strata occur within the limits of the State. Commencing with the most ancient, we have first a collection of metamorphic beds, comprising talcose and chloritic schists, with quartzites, siliceous slates, and bands of crystalline limestone, the whole being undoubtedly referrible to the Laurentian series of our Azoic rocks. The great iron deposits of Marquette belong to this division. The existence of Huronian strata within the peninsula does not appear to have been made out. To these Azoic rocks succeed the so-called " Lake Superior sandstones " of the age of the Potsdam group, but they are only developed in the higher portions of the State. The Calciferous sandrock is said to be unknown to the south of the Falls of Ste. Marie, the silicious and other limestones of the Trenton group immediately succeeding the Potsdam beds. It may be found, however, eventually, that much of the Lake Superior sandstone really belongs to the Calciferous subdivision, although we have not sufficient data at present to establish this. Many of the common Chazy and Trenton limestone fossils are cited by Professor Winchell from this outcrop of the Trenton group ; and the formation is stated to stretch in a belt about four miles wide across St. Joseph's Island, and to reappear in the high bluffs opposite Little Sailor Encampment. From thence it extends across the middle of Great Sailor Encampment Island, and passes west in a gradually widening belt to the shores of Bay de Noquet and Green Bay, and onwards across Wisconsin into northern Illinois. Thirty-two feet is cited as its observed thickness in Michigan. The Hudson River deposits lie along the southern outcrop of the Trenton beds. Their dip carries them under the lower portion of the peninsula, but they do not reappear on the southern side of the basin, being covered at the anticlinal by some of the overlying beds. They are seen, however, further south, as in the denuded axis of Cincinnati, and elsewhere.

The Upper Silurian formations recognized in Michigan, comprise the Clinton and Niagara group, and the Onondaga-salt division. Some gypsum and a few brine springs occur in the latter, but the great salt formation of the peninsula belongs to a much higher deposit, a member of the Carboniferous series. The Devonian rocks are largely developed. They include, in ascending order, the upper Helderberg group, 354 feet thick, comprising the peculiar brecciated limestone of Mackinac, and other arenaceous and bituminous limestone deposits ; the Hamilton group of bituminous and other limestones, 55 feet in thickness ; the Portage group, 224 feet thick ; and the Chemung group of 159 feet.

The Portage group in this Report, is called provisionally the "Huron group," an objectionable term, as likely to be confounded with the very dissimilar Huronian series of Canada. The Chemung subdivision is also described as the Marshall group, after the town of that name in Calhoun county. In neither of these sets of strata have any explorations been made, as yet, in quest of petroleum; nor have any natural "oil springs" been discovered amongst them. The fossils collected from the higher group are stated by Professor Winchell to be specifically distinct from those obtained from the Chemung beds of more eastern localities.

Continuing to ascend in the geological scale, we now reach the great Carboniferous formation. This, as occurring in Michigan, is subdivided in the Report into six separate groups, according to the following order. First, a series of micaceous sandstones, the so-called "Napoleon group," separated from the underlying Marshall deposits by a bed of clay or argillaceous shale. Secondly, the "Michigan salt group," comprising various shales and limestones, with gypsum and marl beds. This is the great brine formation of Michigan, a kind of repetition, as it were, of the Onondaga salt or gypsiferous group of more eastern sites. Some of the sandstones of the lower or "Napoleon" group, however, are also highly saliferous. Next follows the Carboniferous Limestone, 66 feet thick, succeeded by the so-called Parma Sandstone, a subdivision considered to represent the Ohio conglomerate, though here separated from the Devonian rocks by three intervening groups of calcareous and arenaceous deposits. The Coal Measures come next in order, attaining in some places to a thickness of over 120 feet. The coal seams, which consist of bituminous varieties, are said to reach in the aggregate a thickness of eleven feet. A single seam, averaging from three to five feet, appears to extend continuously throughout the formation, and to furnish material of good quality. It is chiefly worked at Woodville. Fire clay and some thin bands and nodules of iron-stone occur in connexion with it. Above the Coal Measures, a thick arenaceous deposit is met with. This, which much resembles the rock beneath the coal strata, is called the Woodville Sandstone; but Professor Winchell remarks that these three latter formations, though separated for convenience, should strictly be united, and ranked collectively as the Coal Measures proper. With the Woodville Sandstone, the entire Palæozoic series of Michigan is brought to a close; and the next succeeding deposits are those of the Drift or Quaternary Period. Before turning our attention to these, we extract from the Report a few observations of much interest in reference to the geological relations of the groups already alluded to :—

" Many interesting considerations present themselves on a general review of the geology of the peninsula. From the Lake Superior Sandstone to the close of the Helderberg period, our state seems to have had a common history with Canada West, and the States on both sides of us. The same groups of rocks are traced uninterruptedly from New York across the peninsula of Canada to Michigan and even to the Mississippi river, preserving throughout that whole extent as great a degree of palæontological identity as could be expected of faunas stretching over so many degrees of the earth's surface. It is true, as has been long since shewn by Prof. Hall, that nearly every member of the Silurian and lower Devonian system, thins gradually in its westward prolongation, loses somewhat of its arenaceous or argillaceous character, and becomes at the west much more calcareous—changes which have generally been regarded as proving the origin of the materials of those groups to have been at the east. It is interesting to observe, however, notwithstanding this westward attenuation, how completely we are able to recognize all the essential features of the New York System in our own State.

" From the close of the Helderberg period, on the contrary, Michigan has had a history to some extent peculiar. The rocks of the Hamilton group can indeed be traced almost continuously from New York into our own State, but the palæontological characters are found materially changed, and the strata are more argillaceous. The Portage Group, of New York, supposing it to be represented by our Huron group, has received great accessions of argillaceous matter, and seems to have been deposited under circumstances more unfavourable to the existence of animal life. The Chemung Group, supposed to be represented by our Marshall Group, has been traced uninterruptedly into Ohio, where it becomes almost non-fossiliferous. The Marshall Group is totally isolated from rocks of the same age anywhere beyond the limits of our peninsula; and though the sandstones bear some physical resemblance to those of the Chemung Group of Ohio and New York, our formation contains little or no argillaceous matter; its fauna is remarkably rich, and its species are nearly all peculiar. The Napoleon Group, if correctly separated from the Marshall Group, has no distinct equivalent in surrounding States ; and its entire destitution of organic remains will cause its true geological relations to remain in doubt.

" If anything were wanting to show that the geological column in Michigan has been built up as a distinct and independent structure, the existence of the gypseous or Michigan Salt Group, supplies the deficiency. But even further than this, no obvious parallelism has yet been traced between the overlying carboniferous limestone, and the groups of this system further west. The indications already pointed out, however, lead to the conjecture that our limestone was accumulating during several of the epochs into which geologists have divided this period, though the isolation of our sea has resulted in little correspondence of organic remains. The paucity of rock-producing materials seems to have continued through the epoch of the coal—our measures not attaining one-twentieth the thickness of the same rocks in Ohio. The evidences lead us to the conviction that the Onio and Michigan coal basins were never continuous, and that the waters did not flow over the separating ridge between the close of the Helderberg period and the Drift. It cannot be denied, however, that, supposing the carboniferous sea to have been a general one, the remoteness and comparative isolation of the Michigan bay, furnished occasion for great contrasts in stratigraphical, lithological and palæontological characters.

"One other class of facts must be referred to, which weigh in the same direction. They constitute evidence that the materials for our upper Devonian and carboniferous rocks have been derived from the north. The Helderberg limestones are 350 feet thick at Mackinac, and not more than 60 feet thick in Monroe county. The Hamilton Group, so well developed in Thunder and Little Traverse Bays, is not recognized in the southern part of the State. The Huron Group, with its gritstones and flagstones at Pt. aux Barques, contains only two strata of flagstone at Grand Rapids. The conglomerate at the base of the Marshall Group, at Pt. aux Barques, is recognized at none of the Southern outcrops. The pebbles scattered through the Marshall and Napoleon Groups in Huron county, are entirely wanting in Jackson and Calhoun counties; while, on the contrary, extensive patches of the Marshall sandstone are found finely cemented by calcareous matter at Battle Creek, Jonesville and other southern points.

"One other remark is suggested by this review of our rocks. The geology of Michigan discloses little connection between the Carboniferous Limestone and the Coal Measures; while the transition to Devonian rocks is imperceptible. I see no reason for drawing the broad lines which separate great systems, between the Marshall and Napoleon groups, or between the Napoleon group and the Carboniferous limestone. On the contrary, I see this limestone characterized by a peculiar, persistent, marine fauna, while the Parma Sandstone, the Coal Measures and the Woodville Sandstone, were accumulated in shallow waters near shores, or even in marshes; and are characterized, from bottom to top, by evidences of the proximity and abundance of terrestrial vegetation. These contrasts hold throughout the country, and in all countries. Whatever marine remains are found in the coal measures, belong to species distinct from those in the Carboniferous Limestone; and if the generic distinctions are not complete, the organic facies of one is vegetable and terrestrial; that of the other, animal and marine. Downward the types of the lower Carboniferous rocks descend into the upper Devonian—some carboniferous species, and numerous carboniferous types, even reaching the Hamilton group. Observations in Michigan suggest rather to draw the broad systematic lines below the Hamilton group, and between the Carboniferous Limestone and the Coal Measures."

As remarked above, the Drift deposits, in Michigan, immediately overlie the Carboniferous Formation. The rocks beneath the Drift shew the usual glacial striæ, and the lower Drift beds consist of boulder-holding clays. To these succeed accumulations of sand, &c., of more or less local origin, containing in some places, as at Grand Traverse Bay, layers of lignite, with imbedded coniferous stems. That these higher Drift accumulations are of fresh-water formation, is shewn by the presence of shells belonging to *melania* and *physa*, which occur above the lignite deposits. These shells, at Traverse Bay, are found in a bed of coarse sand, mixed with small boulders, and overlaid by twelve feet of fine yellow sand. The formations of still more recent date, comprise peat, shell-marl, and iron ochres. Remains of the *Elephas primigenius*, and those of the Mastodon and Elk, with a caudal vertebra of a whale, have been obtained from these modern accumulations.

In closing our brief notice of this Report, we may add that its pages bear abundant evidence of the very able manner in which Professor Winchell has carried out the work committed to his charge. The publication of the author's final Report may be looked forward to with much interest. E. J. C.

*Manual of the Sub-kingdom Coelenterata.* By Joseph Reay Greene, B.A., Professor of Natural History, Queen's College, Cork. London: Longman, Green, Longman and Roberts. 1861.

We receive with pleasure a second part of Professor Greene's Manuals of the Animal Kingdom. The present volume, like the preceding, is full of valuable materials for study, and it gives the view of the subject which seems at present to find most favour with European naturalists. We cannot recognize Coelenterata as a Sub-kingdom, nor admit the classification of its supposed members which is here presented. We believe that when relieved from the Protozoa, and some groups properly belonging to the Articulata, the Sub-kingdom Radiata is truly natural, and distinguished by clear and important characters, and with some transferences of families, we regard the classes Echinodermata, Acalephæ and Polypifera as expressing their proper Sub-division. We must also press the claim of Acalephae to the Ctenophoræ, which are placed among Actinozoa, (our Polypifera,) by Professor Greene. These matters, however, are at present subjects of controversy, and in indicating the views which our inquiries thus far dispose us to consider as most satisfactory, we do not undervalue the work before us as a source of information, and an excellent interpretation of a system with which we must desire to be acquainted. We only strongly recommend to the student a careful comparison of the opinions and statements of Professor Greene, with what he will find in the volume of Agassiz, on the Acalephae. In this short notice of a useful summary we cannot discuss the disputed questions, but they are of such leading importance, as to affect the use of the work as a text book, where its doctrines are not received.

W. H.

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*Outlines of Elementary Botany, as Introductory to Local Floras.* By George Bentham, Esq., V.P.L.S. London: Lovell Reeve. 1861.

We have here a work of small size and modest pretensions, but of the highest merit. It proceeds from one of the first botanists of our age—one who most eminently unites with great opportunities and a careful observation of facts, sound judgment and logical habits of mind. We have here in the compass of five and forty pages, the substance of volumes, and the means, with careful study and reflection, of laying a good foundation for the highest botanical acquirements. So clear and accurate is our author's language, that he seems independent of pictorial illustrations, and much as these seem sometimes to assist beginners, they are so apt to be misused for saving labour which ought to be gone through, that if they were confined to the lecture-room of the teacher, the loss to science would not be great. So very much do we admire Mr. Bentham's work, that we reluctantly notice faults, though of secondary importance, and detracting little from the general merit. At p. 18, ¶ 100, he says: "The Corolla is said to be *Monopetalous* when the petals are united, either entirely or at the base only, into a cup, tube, or ring; *polypetalous* where they are all free from the base. These expressions, established by a long usage, are not strictly correct, for *monopetalous* (consisting of a single petal,) should apply rather to a corolla really reduced to a single petal, which would then be on one side of the axis; and *polypetalous* is sometimes used more appropriately for a corolla with an indefinite number of petals. Some modern botanists have, therefore, proposed the term *gamopetalous* for the corolla with united petals, and *dialypetalous* for that with free petals; but the old established expressions are still most generally used."

We apprehend it to be a proper aim of writers like Mr. Bentham, to correct what is wrong in "old established" ideas and expressions, and in science we are sure that accuracy of expression is essential for the diffusion of clear and correct ideas, so that if even great authorities are found resisting needful improvements, the movement belongs to those who insist on their importance. *Gamopetalous* is, after all, an awkward figurative term ; but to *Synpetalous* and *Synsepalous*, there can be no reasonable objection, and *apopetalous* or *dialypetalous* will serve for the contrasted term. If being established is a good excuse for retaining a term, invented when the true nature of the case was not understood, and expressing a false view, we see no chance for improvement.

Again, we cannot help objecting very strongly to the use of *Pistil*, as a collective name for the carpels which make up the inner circle of the flower : *Gynæcium* we think the most appropriate term. A pistil, according to Linnaean ideas, is an apparently distinct part of the gynœcium, being either one of the carpels of an apocarpous gynœcium ; one style and stigma where the ovarian portions of the carpels cohere, or the seemingly single organ formed by the complete coherence of the carpels.* With our present views of structure, such a term is useless except in applying the Linnaean System, and ought no longer to be employed in descriptive botany. The inner circle of the parts of a flower is the gynœcium, its several parts or the several modified leaves of which it consists are carpels, and each carpel consists of ovary, style, and stigma. We cannot accept, judging from our own experience and reading, Mr. Bentham's statement that *pistil* is generally applied in a collective sense, and we believe it to be now generally used in a very vague manner, which needs correction ; this is easily applied by using pistil only in its Linnaean sense, and having good names both for the whole circle, the several pieces of which it is composed, and the distinguishable parts of each.

We note minor objections because so few occur to us, and we so very much admire and value the work, which we in conclusion most warmly recommend to all who are engaged in botanical studies.

W. H.

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* Observing that the Linnaean use of the term *pistil* has been a subject of controversy, we turned to the *Philosophia Botanica* and carefully re-examined every sentence in which the word occurs. The result is a confirmed conviction that Linnaeus could not possibly have intended *pistil* as a general name for the inner circle of a flower. He speaks of pistils as one or more. The theory of the carpels not having been yet thought of, an entire or almost entire union of styles and stigmas was to him one pistil, whilst any considerable separation of styles, with or without coherence below, was regarded by him as several pistils. His authority cannot be used in favour of Mr. Bentham's application of the term, which is otherwise very objectionable.

# SCIENTIFIC AND LITERARY NOTES.

## GEOLOGY AND MINERALOGY.

### ON ELEVATIONS AND DEPRESSIONS OF THE EARTH IN NORTH AMERICA, BY ABRAHAM GESNER, M.D., F.G.S.

(*From the Journal of the Geological Society, November* 1861)

*United States.*—Commencing at New Jersey, in the United States the writer has examined nearly all the most interesting parts of the coasts, as far northward as the northern part of Labrador. The whole south-eastern side of New Jersey, where it borders upon the Atlantic, to the extent of 100 miles in length and about 20 miles in breadth, is composed of alternate strata of sand, greensand, marl, and clay, some of the beds very highly fossiliferous. The land is comparatively low, and slopes gradually from the high lands in the rear towards the sea. A similar tract of country occurs in the bordering State of Maryland, and, still further southward, in North Carolina.

The oldest inhabitants of New Jersey, whose lives have been extended to upwards of eighty years, maintain that within a period of sixty years the sea has risen upwards of four feet, or what is equivalent thereto, the coast has fallen to that depth. Marshes that were formerly mowed for their grass are now submerged ; the sea has encroached upon the land, even over the sites of ancient habitations. There are tracts where trees are seen growing upon fallen forests, which have been buried in sand and peat. Timber of excellent description is dug out of the present marshes. The amount of depression along this coast is variously estimated as being from 5 to 12 feet.

From these and other facts which might be quoted, it appears that there are marine Cretaceous deposits, and over them Pleistocene deposits with freshwater shells and Mastodon bones, apparently an old forest buried in sand, with the remains of another growing over it—these two being under the sea in some places and therefore proving submergence of a land-surface,—and that this submergence is still going on, according to the testimony of the inhabitants and the submergence of habitations.

In the harbour of Nantucket, there is a submarine forest. In dredging the estuary, Lieutenant Prescott found trunks and roots of the cedar, oak, maple, and beech, some of them standing upright and still attached to the soil on which they flourished. Excepting the cedar, all the woods are still sound. The trees are partially buried in sand, and are eight feet below the level of the lowest tide.

A similar submarine forest exists at Holme's Hole, on Martha's Vineyard. On the west side of the harbour, stumps of trees are found standing upon a level surface beneath the water ; another woody tract occurs near the south-west extremity of the Vineyard, and on the north side of Cape Cod, opposite Yarmouth : the latter extends more than three miles into Barnstable Bay. At Portland a similar sinking of the land has been clearly made out. In none of these instances is there any accounting for the facts but by actual subsidence. No indications of elevation were observed in this quarter.

*New Brunswick.*—Proceeding in a northerly direction, we arrive at the River Schoodiac, or St. Croix, the dividing line between the United States and the British Province of New Brunswick. Instead of submergence, an elevation of the land is here clear and distinct. It extends in a northerly direction upwards of twenty miles, and probably to a still greater distance along the coast in the direction of the Bay of Fundy. The greatest elevation is near the centre of this area, which has been but little raised at its edges. The solid rocks beneath the modern marl-beds are chiefly red sandstone, syenite, and granite, with intrusions of trap-rocks.

At St. Andrew's, St. Stephen's, Lubec, Eastport, and numerous sites in the adjacent districts, there are extensive deposits of sand, marl, and marly clay, containing relics of shells and sea-weeds which still inhabit the present shores; and the former are so numerous, that they have contributed sufficient lime to some of the strata to render them valuable for fertilizing-purposes. At first these marl-beds were supposed to be Tertiary deposits; but late observations have determined their more recent origin. The greatest elevation observed was near the town of St. Andrew's, where the marl with recent shells is found 28 feet above the level of the highest tide.

Among the numerous islands of Passamaquoddy Bay the writer observed many of indications of elevation; nor is it difficult to discover along the borders of the creeks and rivers the sites from which the sea has been slowly and gradually withdrawn. Strata of marl and clay with shells like those before mentioned, appear at Beaver Harbour, where the elevation has been less considerable.

Grand Manan is a beautiful island, situated off the mouth of the St. Croix River, and 12 miles from the American line. It is 25 miles long and 5 miles in breadth. The north-west side is a somewhat lofty range of trap-rock, uninhabited and presenting to the sea perpendicular and overhanging cliffs. The opposite side of the island is inhabited; the industry is agriculture and fishing; and a number of small islands and harbours afford shelter for vessels.

The most remarkable circumstance connected with this isolated part of New Brunswick is the fact, that the entire south side of the main and its islets have within a recent period been submerged to the depth of 18 feet and upwards.—There still remains a tradition that there once existed between the main, the three Duck Islands, and Nantucket Island, a kind of marsh of several thousands of acres. This marsh has slowly disappeared beneath the sea; and its surface is only partially uncovered by the water at the lowest spring-tides. The roots stumps, and trunks of a great number of trees (the pine, hemlock and cedar) still remain firmly attached to the sunken earth, and at the very sites where they flourished. The once living forest with its branches and leaves is now deeply covered by each succeeding tide. The anchors of small craft are often held fast among the wood of the bottom of the harbour. It was by this subsidence that several islands became isolated; for the marshes that formerly attached them one to another have been denuded and washed away by the waves. The subsidence extended to the distance of several miles westward; but it is best measured near the small islands before mentioned. Viewed altogether, it would seem that Grand Manan has slowly moved upon its axis, depressing one side and elevating the other.

At the mouth of the River St. John and at the city of the same name, in the Province of New Brunswick, the evidences of elevation are distinct over an area of twenty square miles. Between the city and Portland there is a narrow and deep valley now occupied by a church, manufactories and dwelling-houses. In this valley, and above strata of clay, there are marl-beds containing marine shells and decomposed sea-weeds identical with those still inhabiting the shores of the harbour. These beds are about 18 feet above the level of the sea, which at some former period surrounded the site of the city.

At Manawagonis, Mispec, Emerson's Creek, and many other places in this quarter, there are beds of sand, clay, marl, and marly clay exposed to the sea, forming low and almost level tracts along its borders. Similar deposits also occur in the banks of the St. John and Kenebecacis Rivers, above the reach of the highest tides. They not only appear where the currents have exposed the beds, but also remote from those streams. The shells are chiefly imbedded in the sand and marl, which also contain the relics of recent marine vegetation.—In these deposits upwards of twenty genera of recnt *Testacea* and six genera of *Crustacea* have been obtained. Some of the shells, such as the *Mya mercenaria*, *Pecten*, *Arca*, &c., are well preserved. The shells of the *Solen ensis* and *Mytili* are too brittle to be removed. The claws of crabs and the bones of fishes, although changed, are not destroyed. The shells of the uppermost beds are more decayed than those of the lower deposits, and appear as though the elevation had been slow and gradual, and not sudden like those frequently indicated in districts moved by earthquakes. The strata containing these remains are now from 10 to 40 feet above the level of the tides, which rise 30 feet along this part of the coast at spring-tides.

The rivers emptying into the Bay of Fundy along this line of coast are broken by falls at their mouths; but the streams which do not pass through this raised district empty themselves into the bay smoothly and without interruption. It is therefore not unreasonable to believe that the breaking up of the river-beds was coeval with the elevation of the shelly deposits now removed far above the reach of the waves.

The next site to be noticed is remarkable for its submergence ; it is called the Great Tantamar Marsh, situated 120 miles eastward of the St. John, in the County of Westmorland, and at the head-water of Chignecto Bay. This marsh is 13 miles long, and about 4 miles broad. Large tracts have been rescued from the sea by embankments, or "dikes," thrown up on the borders of the river, and its creeks. At the eastern extremity of the Tantamar, there is a sunken tract, composed of peat-bog, floating bogs, with swamps and small lakes, not less than 8 miles long and 3 miles in width. It is the breeding-place of great numbers of wild ducks and snipes. Large trees of different kinds, collections of shells, bones of fishes, &c., appear at different depths in the alluvium. But besides these, on the northern border of the alluvial deposit, patches of forest-trees, some of which have been felled by the woodman's axe, are now overflowed by the tides. Relics of the early French settlers, Indian harpoons, and pieces of their bark canoes, and other traces of the aborigines have been dug up at depths of 5 and 10 feet beneath the surface, on the opening of canals and ditches remote from the river.

The same depressing influence has been at work at Shediac and Bay Verte.—At the latter place the gravestones of persons killed by the Indians in 1755 are now reached by the tide at high water, which washes the base of old Fort Moncton, and rises above its causeway.

In the County of Northumberland, where it borders upon the Bay de Chaleurs there has been a depression, evidently slow in its progress and continued. In the vicinity of Bay des Vents and LowerBay des Vents, extensive peat-bogs are seen at low water reaching outwards beneath the sea : the peat is of super-marine growth, and its highest parts are scarcely above the tide-level. The shores are low and level ; and evidences of land-slides are absent. At Bathurst, on the contrary, and on the opposite shore of Lower Canada, there has been an elevation of several feet, and which apparently is still progressing. A number of minor elevations and depressions were observed during the writer's geological survey of the Province, before leaving which the terraces along the Upper St. John River may be adverted to, as being connected with this subject.

On the banks of this river we frequently observe, in ascending from its borders, several paralled steps which rise abruptly from one level to another in succession. These steps are composed of diluvial matter, in which there are occasionally contained decayed timber and fragments of freshwater shells. These are well displayed near the ferry four miles below Woodstock.

These several terraces mark distinctly the former banks of the river, which has been withdrawn from its ancient limits to a narrow channel with an increased velocity of current. Near the mouth of Maduxnakeag, a tributary of the St. John, the ancient bed of the stream is now dry and under cultivation.—Whether these terraces have been produced by an uplifting or depressing force, it is difficult to ascertain. It is probable, however, that the site of the river was once a lake, which has been drained by the yielding of the earth further down the stream, where there are now violent rapids and marks of recent terrestrial disturbance. Terraced valleys are common on many of the rivers of North America.

*Nova Scotia.*—At many places in Nova Scotia, changes of level on the surface of the earth appear very distinct, although they are less manifest than they are in the sister Province. It is generally maintained by aged persons, that the tides flowing into the Bay of Fundy and Minas Basin and its numerous rivers and creeks, are rising. The records of ancient landmarks, the encroachment of the water upon the dry earth, the discovery of ancient bridges and relcs of the native Indians beneath the present tide-level, corroborate that opiniion. At numerous places in the marshes of the Shubenacadia, Avon, and King's County Rivers, the alluvia of the sea are perfectly stratified. Some of these strata and those called " blue marsh " are composed in part of plants still undergoing decomposition and expelling carburetted hydrogen. These strata are sometimes 12 feet beneath the surface, and interlaid with beds of alluvium, which, when their layers are exposed, display with beautiful distinctness the tracks of the numerous wading birds that frequent the shores. It is almost unnecessary to add that sea-alluvia never accumulate above the highest tide mark.

On the southern side of this Province, where it meets the Atlantic, the old fishermen universally report the effects of uplifting at certain places where they have been wont to anchor their nets and boats in pursuing their avocation. Off the harcor of Halifax, and Sambro Lighthouse, a submarine elevation appears to be advancing. A few years ago a steamer was wrecked in breakers six miles south of the lighthouse, after a gale of wind : breakers at that place were unknown before. Recent soundings also show a shallowing of the water.

*Cape Breton.*—In the Island of Cape Breton, situated at the entrance of the Gulf of St. Lawrence (and which the writer had an opportunity to explore under the patronage of the late noble Earl of Dundonald), several upheavings and depressions of the land were observed, not dissimilar to those already mentioned. Among the latter is that of the ancient city of Louisburg, which forms an interesting feature in Colonial history. This place was once the stronghold of France in America, and has one of the finest harbours in the world. It was well fortified: and a population of 20,000 souls was contained within its walls. It was taken from the French by 4000 provincial troops, under Colonel Pepperall, in 1745. Afterwards Great Britain restored it to France. In 1758 it was again captured by General Amherst. The place was defended by 3000 men six ships of the line, and five frigates: in this action the brave General Wolfe won an early distinction. The inhabitants of the city were dispersed; and the British Government expended £40,000 in blowing up the fortifications. The city is now occupied by six families of poor fishermen ; two stories of the hospital remain, as do the foundations of the Governor's house and other public buildings, with much of the massive masonry of the bomb-proofs and bastions. Among the ruins are seen fragments of exploded shells and other missiles, mingling with the crumbling bones of the killed. Had Louisburg continued to exist up to the present time, its abandonment would not have been the less certain, for the sea now flows within its walls and overflows sites that were formerly inhabited. Its submersion is plain and distinct. The rock upon which General Wolfe landed has nearly disappeared. The waves break against the south wall which they have undermined and thrown down. The higher parts of the fortress afford shelter for sheep ; but each succeding tide flows freely into the northern side of the deserted city. The lands westward also bear testimony to an extensive submergence.

*Prince Edward's Island.*—The fertile Prince Edward's Island is situated in the Gulf of St. Lawrence, fifty miles eastward of the Province of Nova Scotia. It is composed of red sandstone ; no workable strata of coal have been found within its limits. Of several sinkings of the earth noted by the writer during his geological survey of the island, one of them merits attention as being more recent than any other that met his observation. It is situated between Lennox Island and Cascumpec, a deep and well-sheltered harbour. The sea has here thrown up mounds of sand from the shallow water, which are separated from the mainland by lagoons. The lagoon between Richmond Bay und Cascumpec is upwards of thirty miles in length. Cascumpec lagoon is a beautiful sheet of water, eighteen miles long and a furlong in breadth, abounding in shellfish and wild fowl; its mainland side is a dense wilderness, and this part of the coast was explored in canoes paddled by Indians.

The harbour of Cascumpec is formed by an extensive peat-bog on one side, and a long mound of sea sand on the other; it has sufficient water to float the largest ships. The peat forms a perpendicular wall which was measured at low water, and found to be 19 feet beneath the sea. It is also perpendicular above the water and forms the shore to the distance of two miles and a half. This peat-bog is composed of the common sphagneous plants interlaid with the pine, hemlock, and other forest-trees and low bushes, some of which are still in upright positions. There are no higher lands in the rear from which this bog could have made a slide, nor any remaining site from which it could have departed.

In the lagoon, the sea had flowed, at the time of the writer's visit, into groves of maple, beech, birch, &c., which are constantly falling down from the sea-water overflowing their roots. The marshes where they meet the water, are filled with fallen timber; and all taken together presents a desolate picture of the changes that are still in progress. This part of the island is very low and level; and, from the gradual submergence of the land, the drainage of the country is obstructed, and lands now capable of being cleared and cultivated, will in the course of years be overflowed by the sea, unless the submersion should be arrested.

At numerous places on the shores of the Gulf of St. Lawrence and on the coast of Labrador, deposits of sand and clay containing recent shells and relics of marine plants are found at heights varying from 5 to 80 feet above the level of the sea. These elevated tracts are seen, at considerable distances from the present shores with notches worn out of the rocks by waves and currents of water; there are also limestones perforated by the *Mytilus lithophagus*, from which the sea has long since been withdrawn. At some localities there are also evidences of depression, similar to those already described.

*Labrador &c.*—The Atlantic coast of Labrador and the Island of Newfoundland present the same phenomena, although they are less perfectly delineated by reason of the ice; for ice-floes break down the shore, and icebergs deposit mounds of sand, gravel and boulders along the sea-board, the winter and summer aspects of which are altogether dissimilar.

*Conclusion.*—From what has been stated, it must not be understood that these silent *undulatory* movements of the land are confined to the coasts and estuaries: they are manifest on the borders of the rivers and the great lakes of Canada and also on the tributaries of the Mississippi. Slight shocks of earthquakes are common in Canada and the United States; but it does not appear, in the history of those countries, that any material change in the relative levels of certain tracts has been effected thereby. Admitting, however, that earthquakes have been the cause of sudden sinkings and elevations of the land, and which would produce anomalous results, there is a slow and constant undulatory movement of the earth's surface, which no doubt acts as much on the ocean's bed as upo the dry land.

## METEOROLOGY OF STRATFORD.

### ABSTRACT OF METEOROLOGICAL OBSERVATIONS AT STRATFORD, FOR THE YEAR 1861,

BY C. J. MACGREGOR, M.A.

Approximate height of Stratford above the sea, 1182.

The instruments with which the observations, embodied in the annexed summary, have been taken, were made by Negretti & Zambra of London, England. They are fixed in position in a shed attached to the Grammar School, and are thus protected from being unduly influenced by radiation and the direct force of the wind. Their index and capillarity errors are known, and by the "tables of errors" the readings are corrected at the time of observation.

1. Barometer.

| | | |
|---|---|---|
| Mean height | 28.6955 | |
| Highest | 29.317 | on January 22, at 9 p.m |
| Lowest | 27.943 | on May 7, at 7 a.m. |
| Yearly range | 1.374 | |
| Greatest daily range | 0.951 | from 7 a.m. of Feb. 7th to Feb. 8th. |

The "means" of all the months except June, August, September, and December, were below the mean for the year.

2. Temperature.

| | | |
|---|---|---|
| Mean of the year | 43°53 | |
| Highest | 90°4 | on August 2. |
| Lowest | –20°4 | on January 13. |
| Yearly range | 110°8 | |
| Greatest monthly range | 67°2 | in February. |
| Least " " | 31°6 | in November. |
| Greatest daily range | 36°5 | on May 30. |
| Least " " | 4°2 | on April 2. |
| Warmest month, July, mean temperature | 65°9 | |
| Coldest month, January, " " | 18°6 | |

The "means" of six months, from May to October inclusive, were above the "mean" of the year.

3. Elasticity.

| | |
|---|---|
| Mean of the year | .275 |

4. Humidity (Saturation being 100.)

| | |
|---|---|
| Mean of the year | 81 |

5. Amount of cloudiness (0–10.)

| | |
|---|---|
| Mean of the year | 6.5 |

6. Rain.

| | |
|---|---|
| Number of days on which rain fell | 119 |
| Number of hours during which rain fell | 759.45 |
| Depth in inches | 31.8135 |

The month in which the greatest amount of rain fell, was July, depth. 4.4772 inches. The month in whice the least fell was January, depth, 0.4138 inches.

7. Snow.

| | |
|---|---|
| Number of days on which snow fell.... | 59 |
| Number of hours during which snow fell | 519.45 |
| Depth in inches...................... | 80.4 |

The last day of the winter of 1860–1 on which snow fell was May 1st; first do. of 1861–2, Oct. 23rd. There was frost in every month except August.

8. Aurora.

| | |
|---|---|
| Number of days on which Aurora was visible ..................... | 16 |
| Number of days on which it was impossible to see Aurora......... | 199 |
| Number of days on which it was possible to see Aurora............ | 150 |

## CANADIAN INSTITUTE.

### Session—1861–2.

### FIRST ORDINARY MEETING—7th December, 1861.

Professor Daniel Wilson, LL.D., President, in the Chair.

I. W. Manson, Esq., Spencer W. Wyndham, Esq., W. Nelson Burns, Esq., and James H. Kerr, (Junior Member) elected provisionally by the Council during the recess, were ballotted for and duly elected.

II. *Donations received since the last meeting of the Institute were announced* (see Annual Report.)

III. *The following Papers were read:*

By Professor Wilson, LL.D.:

"On indications of an Asiatic Origin for the American Race."

By P. Freeland, Esq.:

"Description of Wenham's new Binocular Microscope."

### SECOND ORDINARY MEETING—14th December, 1861.

Professor Daniel Wilson, LL.D., President, in the Chair.

I. *The following Gentlemen were elected members:*

Doctor Smith, Bristol, C.E.
Doctor Cranston, Arnprior, C.W.
Walter O'Hara, Esq., Toronto.

II. *The following Papers were read:*

By Professor Croft, D.C.L:

"Description of Griffin's Gas Furnace."

By the Rev. Professor Hincks:

"On a curious variety of Maize from Oregon, with remarks on some diseased specimens of Maize."

III. The requisite nominations for the election of office-bearers for the ensuing year, were made; and the President announced the Annual General Meeting to be held on the 21st instant, to receive the report of the Council, to elect office-bearers and Members of Council for the ensuing year, and for other business.

### Annual General Meeting—*21st December*, 1861.

Professor **Daniel Wilson**, LL.D., President, in the Chair.

Major R. Dillon, of the 30th Regiment, was elected a member of the Institute.

II. The Report of the Council for the year 1860-61, was read and adopted on motion of S. B. Harman, Esq., seconded by Capt. Thomas Dick.

III. The following Gentlemen, nominated at the last meeting as the office-bearers and Council for the ensuing year, were declared duly elected, viz.:—

| | |
|---|---|
| President, | Hon. J. H. Hagarty, D.C.L. |
| 1st Vice President, | Rev. Prof. G. C. Irving, M.A. |
| 2nd " | T. C. Keefer, Esq., C.E. |
| 3rd " | S. Fleming, Esq., C.E. |
| Treasurer, | D. Crawford, Esq. |
| Recording Secretary, | P. Freeland, Esq. |
| Corresponding Secretary, | Rev. Prof. Hatch, B.A. |
| Librarian, | Prof. H. Y. Hind, M.A. |
| Curator, | J. F. Smith, Jun., Esq. |
| Council, | Daniel Wilson, LL.D. |
| " | Professor E. J. Chapman. |
| " | Rev. Prof. W. Hincks, F.L.S. |
| " | Hon. G. W. Allan, M.L.C. |
| " | Prof. H. Croft, D.C.L. |
| " | Prof. J. B. Cherriman, M.A. |

IV. *The following Papers were read:*

By Professor Croft, D.C.L.:

"A Communication upon an old Chemical Joke."

By Professor Chapman:

"On the peculiar conditions of occurrence of certain Canadian Minerals, illustrated by a series of specimens."

### Third Ordinary Meeting—*11th January*, 1862.

*Business postponed to January 18th.*

### Fourth Ordinary Meeting—*18th January*, 1862.

Hon. Mr. Justice **Hagarty**, President, in the Chair.

I. Charles Robertson, Esq., proposed at the last meeting as a member of the Institute, was ballotted for, and duly elected.

II. *The following Papers were read:*

1. By the President:

"The Annual Address."

The Hon. G. W. Allan moved, seconded by Daniel Wilson, LL.D., that the cordial thanks of the Institute be given to the President for the very able and interesting Address now read.

2. By Prof. H. Y. Hind, M.A., F.R.G.S.:

"A communication embodying observations made during his expedition to the Labrador Coast in the summer of 1861."

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST—OCTOBER, 1861.

*Latitude*—43 *deg.* 39.4 *min. North. Longitude*—5 *h.* 17 *min.* 33 *sec. West. Elevation above Lake Ontario,* 108 *feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Average | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Re-sultant Direc-tion. | Velocity of Wind. | | | | | Rain in Inches. | Snow in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | MEAN. | 6 A.M | 2 P.M. | 10 PM | ME'N | | 6 A.M | 2 P.M | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M. | 10 P.M. | 2 P.M. | | 6 A.M | 2 P.M | 10 PM | Re-sul't. | ME'N | | |
| 1 | 30.054 | 29.906 | 29.744 | 29.8867 | 47.5° | 57.2° | 54.0° | 53.25° | + 2.83° | .283 | .325 | .401 | .341 | .86 | .69 | .96 | .84 | N E b N | E | Calm. | N 80° E | 2.5 | 6.2 | 0.0 | 2.53 | 2.65 | ... | ... |
| 2 | 29.641 | .504 | .487 | .5398 | 50.0 | 64.5 | 59.1 | 59.12 | + 9.18 | .356 | .494 | .438 | .442 | .99 | .81 | .87 | .88 | Calm. | S S W | S W | S 42 W | 0.0 | 13.0 | 8.0 | 8.73 | 9.61 | ... | ... |
| 3 | .631 | .689 | .757 | .7018 | 54.4 | 64.5 | 49.3 | 56.07 | + 6.53 | .318 | .284 | .323 | .303 | .75 | .47 | .91 | .70 | W | W | Calm. | N 52 W | 9.8 | 9.6 | 0.0 | 5.23 | 7.16 | 0.018 | ... |
| 4 | .685 | .636 | .592 | .6255 | 52.2 | 52.9 | 50.9 | 51.52 | + 2.48 | .369 | .372 | .354 | .359 | .95 | .92 | .95 | .94 | E b N | E N E | E b N | N 64 E | 5.4 | 7.0 | 11.8 | 8.63 | 9.10 | 0.625 | ... |
| 5 | .497 | .424 | .383 | .4337 | 49.7 | 59.4 | 55.4 | 55.25 | + 6.63 | .338 | .470 | .428 | .419 | .95 | .93 | .98 | .96 | N b W | E b S | N N E | N 40 E | 1.8 | 4.0 | 0.4 | 2.49 | 3.60 | 0.012 | ... |
| 6 | .438 | .398 | — | — | 55.5 | 51.1 | — | — | — | .369 | .373 | — | — | .84 | .99 | — | — | N | N | N W | N 23 W | 9.0 | 5.0 | 8.0 | 5.91 | 7.32 | 0.415 | ... |
| 7 | .760 | .748 | .736 | .7552 | 40.3 | 52.9 | 48.6 | 47.40 | — 0.45 | .236 | .318 | .302 | .284 | .95 | .78 | .88 | .86 | N W | S S E | N N E | N 21 E | 3.8 | 4.0 | 4.2 | 1.66 | 3.48 | ... | ... |
| 8 | .804 | .853 | .892 | .8610 | 44.3 | 57.3 | 47.5 | 50.28 | + 2.83 | .258 | .357 | .276 | .301 | .89 | .76 | .84 | .82 | N b E | S | S E b E | S 86 E | 6.2 | 5.4 | 2.0 | 1.57 | 4.37 | ... | ... |
| 9 | .952 | .937 | .898 | .9273 | 44.6 | 58.7 | 53.3 | 52.22 | + 5.15 | .235 | .250 | .366 | .291 | .80 | .51 | .89 | .75 | N N E | E | E N E | N 69 E | 6.5 | 5.8 | 4.4 | 4.32 | 5.06 | .. | ... |
| 10 | .877 | .801 | .677 | .7778 | 45.0 | 59.1 | 51.1 | 52.33 | + 5.67 | .288 | .345 | .320 | .327 | .96 | .68 | .85 | .84 | Calm. | E S E | N E | E | 0.0 | 7.3 | 4.4 | 2.15 | 3.76 | ... | ... |
| 11 | .529 | .408 | .425 | .4530 | 51.5 | 56.2 | 50.0 | 52.75 | + 6.50 | .367 | .406 | .335 | .360 | .96 | .90 | .93 | .90 | Calm. | W b S | W b S | S 72 W | 0.0 | 4.5 | 4.0 | 2.02 | 2.99 | 0.058 | ... |
| 12 | .260 | .102 | 168 | .1713 | 40.3 | 47.9 | 43.9 | 45.28 | — 0.68 | .209 | .260 | .218 | .235 | .84 | .77 | .75 | .77 | Calm. | W b S | W b S | S 59 W | 0.0 | 11 5 | 9.2 | 8.31 | 9.50 | 0.005 | ... |
| 13 | .237 | .410 | — | — | 37.0 | 52.9 | — | — | — | .201 | .246 | — | — | .91 | .61 | — | — | W b S | N W | W | N 61 W | 3.1 | 18.2 | 4.0 | 10.86 | 11.35 | 0.005 | ... |
| 14 | .572 | .473 | .604 | .5547 | 36.3 | 63.2 | 48.6 | 50.12 | + 4.85 | .193 | .360 | .269 | .273 | .90 | .62 | .79 | .75 | W b N | S W b S | W N W | S 71 W | 1.8 | 9.2 | 8.2 | 5.74 | 6.73 | .. | ... |
| 15 | .740 | .749 | .764 | .7575 | 35 2 | 53.6 | 46.8 | 46.23 | + 1.38 | .172 | .213 | .282 | .229 | .84 | .52 | .89 | .74 | W b N | S S E | N E | N 69 E | 0.5 | 4.0 | 4.0 | 2.54 | 4.02 | .. | ... |
| 16 | .696 | .627 | .599 | .6383 | 49.3 | 57.2 | 51.1 | 52.73 | + 8.20 | .323 | .392 | .352 | .362 | .91 | .83 | .94 | .90 | N E | E S E | Calm. | S 84 E | 7.8 | 3.0 | 0.0 | 2.23 | 2.49 | ... | ... |
| 17 | .600 | .578 | .546 | .5708 | 53.3 | 61.2 | 56.2 | 56.83 | +12.60 | .377 | .410 | .371 | .381 | .92 | .76 | .82 | .83 | S E b E | E b S | N N E | N 50 E | 2.4 | 3.5 | 5.5 | 2.97 | 4.07 | 0.080 | ... |
| 18 | .465 | .437 | .481 | .4603 | 55.8 | 60.5 | 55.4 | 56.83 | +12.80 | .388 | .419 | .429 | .407 | .87 | .80 | .98 | .88 | N N E | N N E | N E | N 63 E | 6.0 | 2.6 | 1.8 | 3.49 | 4.29 | 0.030 | ... |
| 19 | .412 | .339 | .494 | .4202 | 53.3 | 55.8 | 46.4 | 51.63 | + 7.85 | .399 | .334 | .249 | .320 | .98 | .74 | .79 | .82 | E b S | W | N W b N | N 79 W | 6.5 | 15.0 | 11.0 | 6.04 | 8.02 | 0.072 | ... |
| 20 | .632 | .770 | — | — | 41.0 | 50.0 | — | — | — | .210 | .232 | — | — | .81 | .63 | — | — | W b S | N W b W | Calm. | N 55 W | 4.0 | 15.0 | 0.0 | 6.39 | 7.07 | ... | ... |
| 21 | .939 | .870 | .753 | .8473 | 34 2 | 49.0 | 48.6 | 44.40 | + 1.15 | .177 | .245 | .269 | .222 | .89 | .69 | .79 | .75 | N b E | E b N | E b S | E | 1.6 | 13.8 | 11.6 | 8.97 | 9.43 | ... | ... |
| 22 | .645 | .508 | .333 | .4765 | 39.2 | 55.5 | 53.6 | 51.03 | + 8.07 | .207 | .337 | .395 | .330 | .87 | .76 | .96 | .87 | N E | S E b E | S b W | S 8 W | 1.4 | 6.5 | 1.6 | 2.80 | 6.47 | 0.455 | ... |
| 23 | .293 | .365 | .543 | .4175 | 44.3 | 45.4 | 33.4 | 40.75 | — 2.00 | .248 | .216 | .163 | .198 | .86 | .70 | .85 | .77 | N W b W | W | Calm. | N 80 W | 20.2 | 14.0 | 0.0 | 9.63 | 10.20 | 0.043 | ... |
| 24 | .723 | .904 | 30.006 | .8990 | 31.6 | 40.3 | 30.9 | 34.27 | — 8.23 | .147 | .176 | .134 | .155 | .83 | .69 | .77 | .78 | N W b W | W N W | N b W | N 55 W | 8.0 | 16.0 | 1.6 | 5.90 | 6.58 | ... | ... |
| 25 | .995 | .896 | 29.884 | .9262 | 34.5 | 51.8 | 45.4 | 45.77 | + 3.48 | .181 | .259 | .253 | .241 | .90 | .67 | .83 | .78 | S | S | S W | S 17 W | 3.8 | 9.0 | 2.8 | 6.04 | 6.32 | ... | Inp. |
| 26 | .808 | .795 | .896 | .8363 | 47.9 | 47.2 | 38.9 | 44.22 | + 2.23 | .278 | .268 | .194 | .247 | .84 | .82 | .81 | .83 | S W b W | N W b N | N W | N 72 W | 6.0 | 5.5 | 6.0 | 4.76 | 6.50 | Inp. | ... |
| 27 | .960 | .963 | — | — | 36.3 | 45.4 | — | — | — | .168 | .162 | — | — | .78 | .52 | — | — | N N W | S | N N E | N 34 E | 7.5 | 6.0 | 7.0 | 1.56 | 4.88 | ... | ... |
| 28 | .908 | .812 | .672 | .7898 | 31.6 | 46.8 | 35.6 | 38.52 | — 2.97 | .118 | .225 | .166 | .176 | .66 | .70 | .80 | .74 | N N E | S S E | E b S | S 75 E | 4.0 | 5.8 | 3.8 | 2.20 | 3.71 | ... | ... |
| 29 | .570 | .309 | .068 | .2892 | 34.2 | 47.9 | 46.4 | 42.82 | + 1.55 | .177 | .221 | .298 | .227 | .89 | .66 | .94 | .81 | N E b N | E b S | Calm. | S 83 E | 4.8 | 7.2 | 0.0 | 3.64 | 5.17 | 0.105 | ... |
| 30 | 28.998 | .032 | .195 | .0910 | 41.7 | 42.5 | 38.8 | 40.83 | — 0.12 | .264 | .227 | .213 | .229 | 1.00 | .83 | .90 | .89 | W | S b W | Calm. | S 44 W | 5.0 | 6.4 | 0.0 | 4.30 | 4.67 | 0.070 | ... |
| 31 | 29.374 | .595 | .787 | .6083 | 40.7 | 47.9 | 43.5 | 43.48 | + 2.73 | .231 | .230 | .250 | .236 | .91 | .69 | .89 | .84 | W S W | N W b W | Calm | N 55 W | 7.0 | 10.5 | 0.0 | 3.52 | 4.08 | ... | ... |
| M | 29.6455 | 29.6036 | 29.6068 | 29.6191 | 43.81 | 53.94 | 47.51 | 48.74 | + 3.70 | .264 | .312 | .298 | .292 | .89 | .73 | .87 | .82 | ........... | ........... | ........... | ........... | 4.72 | 8.21 | 4.04 | ...... | 5.96 | 1.993 | Inp. |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR OCTOBER, 1861.

Highest Barometer........................ 30.054 at 6 a.m. on 1st } Monthly range =
Lowest Barometer ........................ 28.998 at 6 a.m. on 30th } 1.056 inches.

Self-registing Thermom.
Maximum Temperature ............... 71°0 on p.m. of 2nd } Monthly range =
Minimum Temperature ............... 29°0 on a.m. of 25th } 42°0
Mean maximum Temperature ..................... 55°34 } Mean daily range =
Mean minimum Temperature ..................... 41°62 } 13°73
Greatest daily range ............ 31°9 from a.m. to p.m. of 14th.
Least daily range.................. 3°6 from a.m. to p.m. of 23rd.

Warmest day......... 2nd... Mean temperature......... 59.12 } Difference = 24°85.
Coldest day......... 24th... Mean temperature......... 34°27 }
Maximum { Solar.................................. 81°6 on p.m. of 3rd } Monthly range =
Radiation. { Terrestrial.......................... 22°0 on a.m. of 25th } 59°6
Aurora observed on 6 nights, viz.: 10th, 13th, 14th, 24th, 25th, and 27th.
Possible to see Aurora on 17 nights; impossible on 14 nights.
Snowing on 1 day, inappreciable; duration of fall, 1.0 hours.
Raining on 15 days,—depth 1.993 inches; duration of fall 53.6 hours.
Mean of cloudiness = 0.61. Difference from average 0.00.
Most cloudy hour observed, 2 p.m., mean = 0.69; least cloudy hour observed 10 p.m.; mean, = 0.51.

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*Sums of the components of the Atmospheric Current, expressed in miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 1393.90 | 1014.93 | 1251.35 | 1940.96 |

Resultant direction N. 61° W.; Resultant velocity 1.06 miles per hour.
Mean velocity............................ 5.96 miles per hour.
Maximum velocity ..................... 30.9 miles, from 11 a.m. to noon on 13th.
Most windy day .........13th......... Mean velocity, 11.35 miles per hour. } Difference =
Least windy day.........16th......... Mean velocity, 2.49 ditto. } 8.86 miles.
Most windy hour......noon to 1 p.m.........Mean velocity, 9.24 ditto. } Difference =
Least windy hour......1 to 2 a.m. .........Mean velocity 4.01 ditto. } 5.23 miles.

---

2nd. Ground Fog at 6 a.m.—5th. Sheet Lightning at 8 p.m., and Fog from 7 p.m to midnight.—7th. Solar Halo during the forenoon (very perfect).—8th. Low Ground Fog from 10 p.m. to midnight.—9th. Solar Halo during most of the day.—10th. Ground Fog at 6 a.m. Solar Halo at 9 a.m.—11th. Ground Fog at 6 a.m. Rainbow at 5 p.m.—13th. Rainbow in N.W. 8 to 9 a.m.—14th. Lunar Corona from 11 p.m. to midnight.—15th. Solar Halo at 2 and 4 p.m.—16th. Foggy from 5 p.m. to midnight. Lunar halo at midnight.—18th. Foggy at midnight and continuing so all night.—19th. Dense Fog at 8 a.m.—21st. Brilliant Meteor at 10 p.m., descending from Zenith towards W. by N.—24th. Snowing slightly from 6 to 8 a.m. (First of the season).—26th. Incessant sheet lightning in S. from 9 to 11.30 p.m. 29th. Dense Fog at midnight.

Heavy Dew recorded on 5 mornings during the month.
Frost recorded on 11 mornings during the month.

---

The Resultant Direction and Velocity of the Wind for the month of October, from 1848 to 1861 inclusive, were respectively N. 56 W. and 1.67 miles.

### COMPARATIVE TABLE FOR OCTOBER.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M'n. | Diff. from Aver. | Max. ob'd. | Min. ob'd. | Range. | No. of days. | Inch's. | No. of days. | Inch's. | Resultant Direction. | Resultant V'y. | Mean Force or Velocity. |
| 1840 | ° 44.4 | ° −1.1 | ° 68 5 | ° 23.9 | ° 44.6 | 13 | 1.860 | 3 | ... | ... | ... | ........... |
| 1841 | 41.6 | −3.9 | 58.3 | 20.3 | 38.0 | 6 | 1.360 | 2 | ... | ... | ... | 0.41 lbs. |
| 1842 | 45.1 | −0.4 | 68.5 | 30.0 | 38.5 | 8 | 5.175 | 0 | ... | ... | ... | 0.35 |
| 1843 | 41.8 | −3.7 | 65.7 | 24.5 | 41.2 | 12 | 3.790 | 4 | 2.5 | ... | ... | 0.54 |
| 1844 | 43.3 | −2.2 | 69.6 | 17.8 | 51.8 | 7 | Imp. | 4 | 12.0 | ... | ... | 0.43 |
| 1845 | 46.4 | +0.9 | 62.7 | 20.0 | 42.7 | 11 | 1.760 | 1 | Inap. | ... | ... | 0.26 |
| 1846 | 44.6 | −0.9 | 69.7 | 20.7 | 49.0 | 14 | 4.180 | 2 | Inap. | ... | ... | 0.44 |
| 1847 | 44.0 | −1.5 | 65.0 | 20.3 | 44.7 | 13 | 4.390 | 2 | Inap. | ... | ... | 0.19 |
| 1848 | 46.3 | +0.8 | 62.2 | 26.4 | 35.8 | 11 | 1.550 | 0 | 0.0 | N 54° W | 1.24 | 4.60mls. |
| 1849 | 45.3 | −0.2 | 59.2 | 25.5 | 33.7 | 13 | 5.965 | 1 | Inap. | N 12° W | 1.27 | 4.76 |
| 1850 | 45.4 | −0.1 | 66.6 | 24.8 | 41.8 | 10 | 2.085 | 0 | 0.0 | N 66° W | 1.10 | 5.30 |
| 1851 | 47.4 | +1.9 | 66.1 | 25.0 | 41.1 | 10 | 1.680 | 2 | 0.3 | S 72° W | 1.06 | 4.39 |
| 1852 | 48.0 | +2.5 | 70.7 | 29.8 | 40.9 | 12 | 5.280 | 0 | 0.0 | N 5° E | 1.19 | 4.47 |
| 1853 | 44.4 | −1.1 | 64.7 | 25.5 | 39.2 | 10 | 0.875 | 2 | Inap. | S 88° W | 1.74 | 4.77 |
| 1854 | 49.5 | +4.0 | 74.2 | 29.8 | 44.4 | 15 | 1.495 | 3 | Inap. | N 45° W | 1.52 | 4.57 |
| 1855 | 45.4 | −0.1 | 64.3 | 28.0 | 36.3 | 14 | 2.485 | 5 | 0.8 | N 82° W | 4.91 | 9.88 |
| 1856 | 45.3 | −0.2 | 70.1 | 23.3 | 46.8 | 10 | 0.875 | 2 | 0.1 | N 76° W | 2.15 | 6.07 |
| 1857 | 45.4 | −0.1 | 63.5 | 27.7 | 35.8 | 10 | 1.040 | 2 | 0.2 | N 19° W | 2.93 | 6.24 |
| 1858 | 48.8 | +3.3 | 76.3 | 34.2 | 42.1 | 17 | 1.797 | 1 | Inap. | N 34° W | 0.36 | 5.96 |
| 1859 | 43.0 | −2.5 | 68.4 | 22.3 | 46.1 | 11 | 0.940 | 4 | Inap. | N 68° W | 5.04 | 8.12 |
| 1860 | 47.3 | +1.8 | 63.7 | 28.4 | 35.3 | 15 | 1.618 | 1 | Inap. | N 9° W | 2.00 | 6.93 |
| 1861 | 48.7 | +3.2 | 64.5 | 30.2 | 34.3 | 15 | 1.993 | 1 | Inap. | N 61° W | 1.06 | 5.96 |
| M | 45.52 | ... | 66.48 | 25.38 | 41.10 | 11.7 | 2.485 | 1.9 | 0.84 | ......... | ... | 5.86 Ml. |
| Diff. from av'g. | + 3.22 | ... | − 1.98 | + 4.82 | − 6.80 | + 3.3 | − 0.492 | − 0.9 | − 0.84 | ......... | ... | + 0.10 |

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—NOVEMBER, 1861.

*Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 m. 33 s. West. Elevation above Lake Ontario,* 108 *feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Average | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resul't. Direc-tion. | Velocity of Wind. | | | | | Rain in inches. | Snow in inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | Mean. | 6 A.M | 2 P.M | 10PM | ME'N | | 6 A.M. | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A. M. | 2 P. M. | 10 P. M. | | 6 AM. | 2 PM. | 10 P.M. | Re-sult'. | ME'N | | |
| 1 | 29.894 | 29.919 | 29.822 | 29.8765 | 41.0° | 43.2° | 43.5° | 42.45° | + 1.98° | .211 | .209 | .240 | .222 | .81 | .74 | .81 | .81 | N E b N | E N E | E b N | N 70° E | 5.0 | 9.0 | 17.5 | 10.77 | 10.94 | 0.415 | ... |
| 2 | .595 | .368 | .121 | .3245 | 41.7 | 39.9 | 40.3 | 40.33 | + 0.07 | .255 | .233 | .228 | .235 | .96 | .95 | .91 | .94 | E N E | N E b E | N E b E | N 51 E | 21.6 | 21.0 | 25.2 | 18.30 | 20.73 | 3.132 | ... |
| 3 | .043 | .085 | — | — | 39.2 | 44.3 | — | — | — | .216 | .214 | — | — | .90 | .72 | — | — | N W | W S W | W S W | S 79 W | 13.3 | 9.5 | 6.0 | 7.83 | 8.25 | .195 | ... |
| 4 | .237 | .298 | .351 | .3022 | 36.3 | 44.3 | 39.9 | 40.05 | + 0.28 | .193 | .204 | .224 | .206 | .90 | .69 | .91 | .83 | W b S | W b S | Calm. | S 75 W | 8.6 | 16.0 | 0.0 | 6.50 | 6.85 | .005 | 0.2 |
| 5 | .241 | .229 | .219 | .2282 | 44.6 | 51.5 | 42.8 | 46.07 | + 6.58 | .264 | .254 | .250 | .256 | .90 | .66 | .90 | .82 | S W b W | S S W | Calm. | S 43 W | 2.5 | 8.6 | 0.0 | 2.46 | 3.83 | ... | ... |
| 6 | .179 | .263 | .426 | .3053 | 44.3 | 50.8 | 37.8 | 43.80 | + 4.63 | .268 | .195 | .190 | .219 | .92 | .50 | .84 | .77 | N N W | N | W b N | N 36 W | 7.4 | 9.2 | 3.3 | 6.23 | 6.85 | Inp. | ... |
| 7 | .514 | .546 | .559 | .5432 | 34.2 | 44.3 | 35.6 | 38.25 | — 0.75 | .168 | .157 | .167 | .164 | .85 | .53 | .80 | .73 | Calm. | N N W | Calm. | N 39 W | 0.0 | 4.3 | 0.0 | 2.89 | 3.13 | ... | ... |
| 8 | .480 | .404 | .411 | .4310 | 34.9 | 44.6 | 41.7 | 40.65 | + 1.97 | .176 | .235 | .210 | .209 | .86 | .80 | .79 | .82 | Calm. | Calm. | N W b W | N 57 W | 0.0 | 0.0 | 1.0 | 0.66 | 1.42 | Inp. | ... |
| 9 | .515 | .553 | .622 | .5702 | 32.4 | 43.2 | 32.7 | 35.92 | — 2.48 | .152 | .122 | .157 | .152 | .83 | .42 | .85 | .73 | Calm. | N W b N | Calm. | N 22 W | 0.0 | 5.4 | 0.0 | 2.26 | 2.42 | ... | ... |
| 10 | .671 | .574 | — | — | 32.4 | 42.8 | — | — | — | .169 | .213 | — | — | .91 | .77 | — | — | N E b N | S E b E | E S E | S 51 E | 1.4 | 12.2 | 6.0 | 7.73 | 9.14 | 0.090 | ... |
| 11 | .220 | .482 | .812 | .5403 | 46.8 | 47.2 | 37.1 | 42.82 | + 5.03 | .295 | .192 | .174 | .210 | .92 | .59 | .78 | .75 | N W b W | W b N | W S W | N 80 W | 9.5 | 30.5 | 9.3 | 15.20 | 15.40 | 0.020 | ... |
| 12 | .974 | .924 | .836 | .9113 | 29.5 | 43.5 | 40.7 | 37.83 | + 0.33 | .144 | .186 | .196 | .179 | .87 | .66 | .77 | .79 | S W b W | S b W | S E b E | S 45 E | 1.0 | 4.5 | 0.8 | 1.37 | 3.59 | 0.025 | ... |
| 13 | .658 | .578 | .700 | .6478 | 42.1 | 44.6 | 39.2 | 41.73 | + 4.55 | .213 | .235 | .164 | .201 | .79 | .80 | .68 | .75 | E | E N E | W N W | N 37 W | 7.0 | 0.6 | 15.5 | 1.11 | 3.44 | ... | ... |
| 14 | .724 | .631 | .510 | .6103 | 38.1 | 41.0 | 34.5 | 37.38 | + 0.48 | .213 | .167 | .114 | .158 | .93 | .63 | .57 | .69 | N W | N W b N | N b W | N 24 W | 11.5 | 7.8 | 1.0 | 5.34 | 6.43 | ... | ... |
| 15 | .439 | .434 | .516 | .4728 | 30.6 | 84.5 | 31.3 | 31.70 | — 4.80 | .131 | .114 | .114 | .118 | .76 | .57 | .65 | .66 | N | N | N W b N | N 36 W | 2.2 | 10.8 | 11.6 | 11.14 | 11.82 | ... | 0.1 |
| 16 | .508 | .550 | .665 | .5873 | 28.8 | 34.2 | 34.5 | 32.37 | — 3.83 | .144 | .131 | .157 | .143 | .90 | .66 | .78 | .78 | N W b W | N W b N | N W b N | N 37 W | 16.8 | 36.8 | 10.4 | 18.92 | 19.10 | ... | 0.1 |
| 17 | .682 | .620 | — | — | 28.7 | 39.2 | — | — | — | .145 | .173 | — | — | .92 | .72 | — | — | W N W | N W | N N W | N 43 W | 5.0 | 15.0 | 10.0 | 9.73 | 9.98 | ... | ... |
| 18 | .666 | .720 | .858 | .7610 | 27.0 | 40.7 | 33.4 | 33.25 | — 2.23 | .129 | .188 | .134 | .144 | .88 | .73 | .70 | .75 | N W b N | N W b N | N b W | N 17 W | 4.4 | 10.2 | 12.6 | 9.11 | 9.38 | . . | ... |
| 19 | .933 | .902 | .836 | .8897 | 27.0 | 38.5 | 36.0 | 33.47 | — 1.62 | .106 | .129 | .172 | .138 | .73 | .55 | .81 | .71 | N b W | S b E | E b S | S 79 E | 2 0 | 2.5 | 8.0 | 4.12 | 4.89 | ... | ... |
| 20 | .727 | .563 | .591 | .6190 | 37.1 | 40.1 | 39.2 | 38.70 | + 3.93 | .158 | .169 | .207 | .182 | .71 | .68 | .87 | .77 | E b S | E b S | N E | S 82 E | 10.0 | 8.0 | 2.0 | 5.18 | 5.30 | 0.127 | ... |
| 21 | .706 | .826 | .862 | .8053 | 37.8 | 42.8 | 35.3 | 38.50 | + 4.12 | .217 | .250 | .198 | .219 | .96 | .90 | .96 | .93 | Calm. | Calm. | Calm. | S 77 E | 0.0 | 0.0 | 0.0 | 0.45 | 0.60 | Inp. | ... |
| 22 | .811 | .522 | .138 | .4535 | 37.8 | 39.6 | 42.1 | 39.87 | + 5.78 | .217 | .184 | .204 | .204 | .96 | .75 | .76 | .83 | S E | E | E | S 72 E | 5.0 | 16.5 | 17.5 | 9.85 | 14.42 | 0.230 | ... |
| 23 | .193 | .153 | .133 | .1583 | 34.2 | 36.7 | 35.2 | 35.20 | + 1.53 | .160 | .163 | .172 | 167 | .81 | .75 | .84 | .81 | S W b W | S S W | S W b S | S 39 W | 16.5 | 13.6 | 2.5 | 6.57 | 7.35 | ... | 0.3 |
| 24 | .091 | .065 | — | — | 30.6 | 32.7 | — | — | — | .144 | .129 | — | — | .85 | .68 | — | — | Calm. | S W b W | Calm. | S 58 W | 0.0 | 3.2 | 0.0 | 1.47 | 1.54 | ... | Iup. |
| 25 | .207 | .323 | .448 | .3440 | 25.1 | 35.6 | 31.6 | 30.67 | — 2.30 | .123 | .167 | .156 | .148 | .91 | .80 | .87 | .86 | Calm. | Calm. | N | N 16 W | 0.0 | 0.0 | 1.0 | 0.47 | 0.48 | ... | ... |
| 26 | .606 | .676 | .747 | .6848 | 27.3 | 39.9 | 30.2 | 32.18 | — 0.38 | .133 | .181 | .142 | .143 | .89 | .73 | .84 | .79 | N N W | S S W | W b N | S 47 W | 0.2 | 6.2 | 2.8 | 1.84 | 3.31 | ... | ... |
| 27 | .621 | .370 | .433 | .4752 | 36.0 | 36.0 | 33.4 | 35.02 | + 2.83 | .180 | .196 | .140 | .166 | .85 | .93 | .74 | .81 | S b E | S b E | S W b W | S 32 W | 12.5 | 9.0 | 16.5 | 7.32 | 11.53 | 0.055 | 0.2 |
| 28 | .658 | .630 | .510 | .6022 | 28.0 | 32.2 | 32.4 | 30.43 | — 1.45 | .117 | .126 | .176 | .139 | .76 | .69 | .96 | .81 | W S W | S W | S E b E | S 30 E | 7.8 | 1.5 | 12.0 | 2.41 | 5.52 | ... | 2.0 |
| 29 | .190 | .358 | .436 | .3343 | 36.0 | 38.9 | 33.4 | 35.73 | + 4.23 | .206 | .160 | .163 | .177 | .97 | .67 | .85 | .84 | Calm. | W S W | W b S | S 78 W | 0.0 | 11.0 | 4.0 | 6.84 | 7.10 | Inp. | ... |
| 30 | .410 | .437 | .590 | .4862 | 32.7 | 33.8 | 27.7 | 31.33 | + 0.25 | .172 | .122 | .106 | .137 | .92 | .63 | .70 | .77 | W b S | W b S | Calm. | S 81 W | 10.5 | 20.4 | 0.0 | 8 34 | 8.42 | ... | 0.5 |
| M | 29.5348 | 29.5253 | 29.5443 | 29.5371 | 35.05 | 40.83 | 36.21 | 37.14 | + 0.99 | .182 | .180 | 175 | .178 | .87 | .69 | .81 | .79 | ......... | ......... | ......... | ......... | 6.06 | 10.11 | 6.35 | ...... | 7.44 | 4.294 | 3.2 |

# REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR NOVEMBER, 1861.

Highest Barometer . . . . . . . 30.000 at 8 a. m. on 12th. } Monthly range=
Lowest Barometer . . . . . . . 29.005 at midn't on 22nd. } 0.995 inches.
Self-registering Ther. { Maximum temperature . . . 52°4 on p.m. of 5th } Monthly range=
Minimum temperature . . . . 23°0 on a.m. of 18th } 29°4
Mean maximum temperature . . 42°39 } Mean daily range=10°40
Mean minimum temperature . . 31°99 }
Greatest daily range . . . . . . . 20°4 from a. m. to p.m. on 10th.
Least daily range . . . . . . . . 3.5 from a. m. to p. m. on 30th.
Warmest day . . 5th ... Mean Temperature . . .=46°07 } Difference=15°40.
Coldest day . . . 25th ... Mean Temperature . . .=30°67 }
Maximum Radiation { Solar . . . . . . . . . . 70°0 on p. m of 7th } Monthly range=
{ Terrestrial . . . . . . . . 12°0 on a. m. of 18th } 58°0.

Aurora observed on 1 night, viz : on 7th. Possible to see Aurora on 11 nights; impossible on 19 nights.

Snowing on 8 days; depth, 3.2 inches; duration of fall, 17.4 hours.

Raining on 14 days; depth, 4.294 inches; duration of fall, 48.1 hours.

Mean of cloudiness=0.74; Difference from average, 0.00 Most cloudy hour observed 8 a.m.; mean =0.78; least cloudy hour observed, 4 p.m.; mean=0.71.

*Sums of the components of the Atmospheric Current, expressed in Miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 1867.64 | 899.10 | 1519.52 | 2522.28 |

Resultant direction, N 46° W; Resultant Velocity, 1.94 miles per hour.
Mean velocity 7.44 miles per hour.
Maximum velocity 36.3 miles, from 2 to 3 p.m. on the 16th.
Most windy day 2nd—Mean velocity 20.73 miles per hour. } Difference 20.25 miles.
Least windy day 25th—Mean velocity 0.48 miles per hour. }
Most windy hour, 11 a.m. to noon—Mean velocity, 11.00 miles per hour. } Difference
Least windy hour, 6 a.m. to 7 p.m.—Mean velocity, 5.58 miles per hour. } 5.42 miles.

2nd. Stormy day. Very high wind and heavy rain.—9th. Solar halo during the forenoon.—10th. Lunar halo at 8 p.m.—11th. Lunar corona from 10 p.m.—14th. Indistinct lunar halo at 7.50 p.m.—16th. Indistinct solar rainbow at 9.20 a.m.—17th. Faint solar halo from noon to 2 p.m.—21st. Fog at 10 p.m. and midnight.—25th. Lunar halo at 5.30 a.m, and solar halo at 9 a.m.—27th. Indistinct lunar halo at 6 a.m.—29th. Fog at 6 a.m.

The averages derived from the observations of the last 22 years shew that November, 1861, was comparatively warm, very rainy, and rather calm; it had a little more than the mean depth of snow, and exactly the average amount of cloudiness.

The Resultant Direction and Velocity of the Wind for the month of November, from 1848 to 1861 inclusive, were respectively N. 76° W., and 2.29 miles.

## COMPARATIVE TABLE FOR NOVEMBER.

| YEAR. | TEMPERATURE. |  |  |  |  | RAIN. |  | SNOW. |  | WIND. |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Mean. | Difference from Average. | Maximum observed. | Minimum observed. | Range. | No. of days. | Inches. | No. of days. | Inches. | Resultant. Direction. | Resultant. Velocity. | Mean Velocity |
| 1840 | 35.9° | — 0.8 | 54.4° | 20.5° | 33.9° | 5 | 1.220 | 8 | ... | ... | ... | ... |
| 1841 | 35.0 | — 1.7 | 63.2 | 7.6 | 55.6 | 8 | 2.450 | 5 | ... | ... | ... | 0.91lbs |
| 1842 | 33.3 | — 3.4 | 50.6 | 7.6 | 43.0 | 9 | 5.310 | 10 | ... | ... | ... | 1.22 " |
| 1843 | 33.5 | — 3.2 | 51.2 | 14.4 | 36.8 | 10 | 4.765 | 7 | 1 2 | ... | ... | 0.59 " |
| 1844 | 34.9 | — 1.8 | 49.8 | 12.0 | 37.8 | 8 | Imp. | 4 | 8.0 | ... | ... | 0.48 " |
| 1845 | 36.8 | + 0.1 | 58.8 | 7.6 | 51.2 | 7 | 1.105 | 4 | 5.0 | ... | ... | 0.53 " |
| 1846 | 41.3 | + 4.6 | 55.5 | 18.2 | 37.3 | 12 | 5.805 | 2 | 0.4 | ... | ... | 0.64 " |
| 1847 | 38.6 | + 1.9 | 58.2 | 7.8 | 50.4 | 14 | 3.155 | 3 | Inp. | ... | ... | 0.36 " |
| 1848 | 34.5 | — 2.2 | 49.3 | 16.5 | 32.8 | 9 | 2.020 | 3 | 1.4 | N 81 W | 1.81 | 4.81ms. |
| 1849 | 42.6 | + 5.9 | 56.7 | 28.4 | 28.3 | 10 | 2.815 | 2 | 1.0 | N 39 W | 1.55 | 4.78 " |
| 1850 | 38.8 | + 2.1 | 62.3 | 18.1 | 44.2 | 7 | 2.955 | 1 | Inp. | N 42 W | 1.43 | 5.27 " |
| 1851 | 32.9 | — 3.8 | 50.1 | 16.5 | 33.6 | 5 | 3.885 | 6 | 6.7 | N 50 W | 1.25 | 4.70 " |
| 1852 | 36.0 | — 0.7 | 50.4 | 18.7 | 31.7 | 7 | 1.775 | 3 | 2.0 | N 59 W | 1.53 | 6.50 " |
| 1853 | 38.7 | + 2.0 | 54.1 | 14.4 | 39.7 | 15 | 2.425 | 6 | 2.7 | N 9 W | 0.55 | 5.52 " |
| 1854 | 36.8 | + 0.1 | 54.9 | 15.1 | 39.8 | 13 | 1.115 | 4 | 1.3 | W | 3.44 | 7.54 " |
| 1855 | 38.6 | + 1.9 | 54.1 | 18 7 | 35.4 | 8 | 4.590 | 6 | 3.0 | N 66 W | 3.18 | 10.81 " |
| 1856 | 37.4 | + 0.7 | 56.4 | 22.8 | 33.6 | 10 | 1.375 | 9 | 9.5 | S 85 W | 2.95 | 8.75 " |
| 1857 | 33.5 | — 3.2 | 57.8 | —2.3 | 60.1 | 14 | 3.235 | 9 | 6.9 | S 61 W | 5.45 | 9.25 " |
| 1858 | 34.2 | — 2.5 | 52.0 | 20.5 | 31.5 | 12 | 3.879 | 13 | 4.0 | N 25 W | 3.14 | 8.87 " |
| 1859 | 38.9 | + 2.2 | 61.0 | 24.1 | 36.9 | 12 | 5.193 | 9 | 0.6 | N 81 W | 3.39 | 9.65 " |
| 1860 | 37.9 | + 1.2 | 62.7 | 14.0 | 48.7 | 12 | 2.569 | 8 | 1.9 | S 89 W | 4.95 | 11.02 " |
| 1861 | 37.1 | + 0.4 | 51.5 | 25.1 | 26.4 | 14 | 4.294 | 8 | 3.2 | N 46 W | 1.94 | 7.44 " |
| Mean | 36.69 | ... | 55.23 | 15.74 | 39.49 | 10.0 | 3.140 | 5.9 | 3.10 | ... | ... | 7.49 |
| Diff. from Av'ge. | +0.45 | ... | —3.73 | + 9.36 | — 13.09 | + 4.0 | + 1.154 | + 2.1 | + 0.10 | N 76 W | 2.29 | —0.05 |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—OCTOBER, 1861.

(NINE MILES WEST OF MONTREAL.)

## BY CHARLES SMALLWOOD, M. D., LL.D.

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. (tenths) | Rain in Inches. | Snow in Inches. | WEATHER, &c. A cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6A.M. | 2P.M. | 10PM. | 6 A.M. | 2 P.M. | 10 P.M. | | | | | 6 A.M. | 2 P.M. | 10 P.M. |
| 1 | 30.315 | 30.250 | 30.160 | 40.0 | 60.9 | 50.6 | .232 | .310 | .309 | .96 | .60 | .85 | s w | s s E | s b w | 4.80 | 2 0 | ... | ... | Fog. | Clear. | Cirr. Str. 8. |
| 2 | 29.952 | 29.748 | 29.474 | 46.4 | 74.3 | 60.4 | .286 | .469 | .456 | .92 | .57 | .88 | s s E | s b E | s b E | 41.00 | 2.0 | ... | ... | C. C. Str. 6. | Cu. Str. 6. | Do. 8. |
| 3 | 678 | 721 | 903 | 61.0 | 64.0 | 50.2 | .449 | .314 | .265 | .85 | .53 | .75 | w b s | w | N N W | 220.80 | 2.5 | ... | ... | Clear. | C. C. Str. 6. | Clear. |
| 4 | 964 | 934 | 988 | 43.0 | 60.0 | 46.1 | .224 | .456 | .286 | .79 | .88 | .92 | s s E | s s E | s s E | 22.90 | 3.5 | In'p. | ... | Cum. | Cu Str. 10. | Do. |
| 5 | 796 | 719 | 758 | 40.0 | 41.6 | 43.0 | .225 | .251 | .261 | .91 | .96 | .95 | N E b E | N E b E | N W | 242.90 | 5.0 | 0.836 | ... | Rain. | Rain. | Rain. |
| 6 | 629 | 647 | 700 | 51.0 | 57.9 | 55.5 | .354 | .429 | .405 | .96 | .91 | .94 | s s E | s s E | N E b E | 94.30 | 4.0 | ... | ... | Cu. Str. 10. | Cu. Str. 8. | Do. |
| 7 | 924 | 932 | 30.020 | 50.0 | 53.1 | 48.2 | .297 | .295 | .310 | .85 | .73 | .91 | N E b E | N E b E | s | 147.10 | 4.5 | 0.523 | ... | Cu. Str. 4. | Do. 6. | Cu. Str. 10. |
| 8 | 30.021 | 30.010 | 074 | 46.4 | 53.0 | 45.1 | .269 | .248 | .275 | .88 | .86 | .91 | W s W | s E | s s w | 12.80 | 3.5 | 0.420 | ... | Rain. | Do. 6. | Clear. |
| 9 | 150 | 127 | 200 | 41.0 | 68.2 | 48.7 | .235 | .476 | .329 | 91 | .69 | .94 | s s w | s | s E | 0.30 | 3.0 | ... | ... | Fog. | Clear. | Clear. |
| 10 | 120 | 100 | 020 | 36.7 | 68.4 | 49.6 | .236 | .536 | .315 | .95 | .77 | .89 | s s E | s s E | E | 1.20 | 3.0 | ... | ... | Fog. | Do. | Clear. A. B. S. |
| 11 | 29.851 | 29.814 | 29.701 | 43.0 | 49.2 | 47.3 | .254 | .322 | 316 | .92 | .92 | .97 | E | N E b E | N E b E | 73.49 | 4.0 | 1.236 | ... | Cu. Str. 8. | Rain. | Cu. Str. 10. |
| 12 | 604 | 406 | 412 | 50.0 | 68.4 | 50.4 | .341 | .606 | .353 | .96 | .86 | .93 | w | W s W | s s E | 88.80 | 5.0 | 1.694 | ... | Rain. | C. C. Str. 6. | Do. 10. |
| 13 | 401 | 394 | 521 | 43.6 | 52.0 | 46.3 | .254 | .208 | .280 | .92 | .53 | .89 | W s W | W N W | w | 229.80 | 5.5 | 0.044 | ... | Cu. Str. 8. | Clear. | Clear. |
| 14 | 682 | 624 | 701 | 41.9 | 59.0 | 49.0 | .228 | .380 | .290 | .86 | .76 | .82 | w s W | W s W | s w | 276.50 | 4.5 | ... | ... | Do. 8. | Cu. Str. 4. | Cum. 2. |
| 15 | 790 | 814 | 972 | 40.1 | 58.4 | 45.0 | .225 | .394 | .245 | .91 | .82 | .80 | s w | s w | s w | 155.90 | 4.0 | ... | ... | Clear. | Clear. | Clear. |
| 16 | 30.070 | 954 | 884 | 35.1 | 50.9 | 46.1 | .183 | .277 | .286 | .90 | .75 | .92 | E s E | E N E | N E b E | 54.40 | 3.5 | ... | ... | Cu. Str. 10. | Cu. Str. 9. | Cu. Str. 10. |
| 17 | 29.801 | 854 | 850 | 45.1 | 68.6 | 56.1 | .275 | .606 | .391 | .92 | .88 | .87 | E s E | s s E | s b E | 20.40 | 2.5 | ... | ... | Do. 10. | C. C. Str. 4. | Cir. Cum. 6. |
| 18 | 710 | 670 | 762 | 54.1 | 49.9 | 45.6 | .390 | .315 | .293 | .93 | .89 | .96 | s s E | N E b E | N E b E | 159.90 | 3.5 | 0.396 | ... | Do. 6. | Do. 8. | Cu. Str. 10. |
| 19 | 697 | 511 | 497 | 44.1 | 48.1 | 45.2 | .265 | .310 | .275 | .92 | .92 | .92 | N E b E | N E b E | w | 158.60 | 5.5 | 0.014 | ... | Rain. | Cu. Str. 4. | Do. 4. |
| 20 | 567 | 814 | 997 | 44.2 | 48.2 | 35.0 | .265 | .285 | .175 | .92 | .85 | .89 | W | W N W | w b N | 430.98 | 5.5 | In'p. | ... | Cu. Str. 8. | Do. 6. | Clear. |
| 21 | 30.151 | 30.160 | 30.172 | 26.0 | 47.0 | 55.6 | .111 | .290 | .177 | .81 | .90 | .85 | w s W | s s W | E s E | 32.80 | 2.5 | ... | ... | Clear. Frost. | Clear. | Do. |
| 22 | 040 | 29.840 | 29.830 | 28.4 | 56.9 | 51.0 | .129 | .275 | .309 | .82 | .60 | .85 | N E b E | E s E | s s E | 88.80 | 2.5 | In'p. | ... | Do. do. | Cu. Str. 8. | Cirr. Str. 8. |
| 23 | 29.461 | 347 | 449 | 50.1 | 54.2 | 41.0 | .341 | .341 | .235 | .96 | .83 | .91 | s s E | w s w | s b E | 230.20 | 5.0 | In'p. | In'p | Cu. Str. 10. | Rain. | Do. 10. |
| 24 | 750 | 891 | 30.200 | 31.3 | 39.0 | 29.0 | .149 | .158 | .129 | .85 | .68 | .82 | w b | w b s | s w | 364.90 | 5.0 | In'p. | ... | Do. 4. | C. C. Str. 4. | Clear. Au. B. |
| 25 | 30.300 | 30.257 | 170 | 21.4 | 45.0 | 57.0 | .090 | .275 | .177 | .79 | .92 | .85 | s s E | s E | s s E | 48.70 | 3.0 | ... | ... | Clear. | Do. 6. | Cir.Str.Ft.do. |
| 26 | 080 | 001 | 29.912 | 36.0 | 51.6 | 46.7 | .162 | .348 | .305 | .84 | .93 | .96 | s s E | s s E | s W | 65.70 | 3.5 | 0.166 | ... | Cu. Str. 10. | Cirr. Str. 10. | Rain. |
| 27 | 100 | 094 | 30.101 | 35.0 | 47.1 | 32.1 | .183 | .273 | .142 | .90 | .85 | .84 | W | N b E | N W | 128.10 | 3.5 | ... | ... | Do. 4. | Cirr. 4. | Clear. Au. B. |
| 28 | 066 | 009 | 29.950 | 30.0 | 41.0 | 33.0 | .142 | .111 | .156 | .88 | .44 | .85 | N N W | s w | s W | 49.60 | 3.0 | ... | ... | Clear. | Clear. | Do. |
| 29 | 29.750 | 29.453 | 541 | 28.0 | 56.0 | 40.5 | .155 | .315 | .197 | .88 | .71 | .78 | s W | s w b s | s s E | 75.00 | 2.5 | ... | ... | Do. | Do. | Do |
| 30 | 301 | 357 | 400 | 30.1 | 44.0 | 41.0 | .156 | .248 | .241 | .85 | .88 | .95 | N E b E | N N E | N E b E | 11.70 | 5.5 | In'p. | ... | Do. | C. C. Str. 6. | Cu. Str. 10.. |
| 31 | 534 | 660 | 876 | 39.0 | 46.1 | 39.4 | .216 | .262 | .210 | .91 | .86 | .86 | N E b E | s w | w s W | 159.90 | 5.0 | 0.041 | ... | Cu. Str. 10. | Cu. Str. 10. | Do. 4. Au.B |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—NOVEMBER, 1861.

(NINE MILES WEST OF MONTREAL.)

## BY CHARLES SMALLWOOD, M.D., LL.D.

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. t'nths | Rain in inches | Snow in inches. | Weather, &c. A Cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | | | | | 6 A. M. | 2 P. M. | 10 P. M. |
| 1 | 30.100 | 30.142 | 30.167 | 30.1 | 47.6 | 36.6 | .148 | .208 | .149 | .89 | .66 | .71 | w s w | s w b s | N E b E | 61.50 | 2.0 | ... | ... | Clear. | C. C. Str. 8. | Cu. Str. 4. |
| 2 | 201 | 29.940 | 29.854 | 30.1 | 34.2 | 36.1 | 148 | 155 | 191 | 89 | 79 | 90 | N E b E | N E b E | N E b E | 258.70 | 2.5 | ... | Inap. | Cu. Str. 10. | Cu. Str. 8. | Rain. |
| 3 | 29.497 | 421 | 387 | 35.1 | 42.1 | 41.0 | 183 | 244 | 241 | 90 | 91 | 95 | N E b E | N E b E | N E b E | 487.00 | 4.0 | 0.214 | ... | C. C. Str. 10. | Rain. | Do. |
| 4 | 371 | 412 | 558 | 40.0 | 48.3 | 39.0 | 248 | 242 | 216 | 100 | 74 | 91 | s s E | s b E | s s E | 98.40 | 4.5 | 0.112 | ... | Light Rain. | C. C. Str. 8. | Cu. Str. 4. |
| 5 | 567 | 521 | 567 | 34.2 | 47.0 | 43.0 | 155 | 258 | 281 | 79 | 81 | 88 | s s E | E s E | N E | 46.40 | 2.0 | ... | ... | Cu. St. 10. | Cu. Str. 10. | Do. 10. |
| 6 | 500 | 465 | 442 | 37.0 | 44.0 | 44.0 | 206 | 265 | 266 | 95 | 92 | 93 | N E b E | N E b E | N W | 87 20 | 1.5 | ... | ... | Fog. | Do. 10. | Rain. |
| 7 | 574 | 567 | 644 | 39.2 | 45.7 | 36.0 | 216 | 198 | 156 | 91 | 65 | 75 | w s w | w | w s w | 209.50 | 1.5 | ... | ... | C. C. Str. 8. | Do. 4. | Clear. |
| 8 | 660 | 567 | 755 | 31.9 | 41.5 | 33.2 | 144 | 126 | 156 | 80 | 49 | 84 | w b s | s w b s | s E b E | 217.30 | 1.0 | ... | ... | Clear. Au. Bo. | Clear. | Cu. Str. 10. |
| 9 | 561 | 642 | 701 | 32.1 | 41.4 | 35.0 | 130 | 190 | 149 | 74 | 73 | 74 | s E | s s E | w | 41.50 | 1.0 | Inap. | ... | Do. | Cu. Str. 10. | Do. 10. |
| 10 | 894 | 30.001 | 981 | 23.0 | 43.0 | 33.0 | 106 | 127 | 154 | 86 | 47 | 86 | s b w | E | s E | 21.70 | 1.0 | ... | ... | Do. Au. Bo. | C. C. Str. 4. | C. C. Str. 10. |
| 11 | 477 | 29.459 | 632 | 38.9 | 42.0 | 40.0 | 216 | 293 | 210 | 91 | 96 | 86 | s s E | E s E | w s w | 220.30 | 3.0 | 0.673 | ... | Cu. Str. 10. | Rain. | Cu. Str. 8. |
| 12 | 30.042 | 30.047 | 30.120 | 32.5 | 57.5 | 32.0 | 162 | 110 | 149 | 89 | 49 | 89 | w s w | w b N | N w | 397.40 | 2.5 | 0.014 | ... | Do. 10. | C. C. Str. 8. | Do. 9. |
| 13 | 29.931 | 29.930 | 29.801 | 27.5 | 34.2 | 33.0 | 111 | 138 | 150 | 75 | 71 | 89 | E | E s E | s b w | 15.80 | 2.0 | ... | ... | C. C. Str. 8. | Cu. Str. 10. | Do. 9. |
| 14 | 754 | 746 | 780 | 31.0 | 38.1 | 30.0 | 136 | 144 | 136 | 78 | 63 | 83 | s w | s w | s w | 333.40 | 1.5 | ... | ... | Str. 4. | Cirr. 2. | Cirr. Str. 2. |
| 15 | 580 | 450 | 484 | 28.5 | 33.0 | 30.0 | 111 | 131 | 148 | 71 | 70 | 89 | w N w | w N w | w b N | 241.90 | 2.0 | ... | ... | Cu. Str. 10. | Cu. Str. 2. | Snow. |
| 16 | 357 | 519 | 617 | 27.3 | 38.4 | 37.3 | 129 | 186 | 157 | 88 | 81 | 71 | s s w | s w | s | 229.20 | 4.5 | ... | 1.10 | Do. 10. | Snow. | Cu. Str. 8. |
| 17 | 650 | 657 | 670 | 31.1 | 39.4 | 30.0 | 142 | 178 | 117 | 84 | 78 | 72 | s b w | s b E | w b N | 236.60 | 2.0 | ... | 0.46 | Do. 10. | Cl'r. Sol. Halo. | Do. 4. |
| 18 | 824 | 797 | 900 | 25.9 | 40.1 | 31.0 | 111 | 160 | 150 | 81 | 64 | 80 | s w b w | w s w | w s w | 48.10 | 2.0 | ... | ... | C. C. Str. 6. | Cirr. 4. | Clear. |
| 19 | 30.026 | 30.147 | 30.190 | 22.3 | 35.2 | 26.2 | 084 | 127 | 088 | 71 | 62 | 62 | w | E s E | s s E | 37.50 | 1.5 | ... | ... | Clear. | Clear. | Do. |
| 20 | 166 | 009 | 020 | 22.0 | 36.6 | 27.6 | 084 | 129 | 105 | 71 | 61 | 70 | N E b E | N b E | N E b E | 134.50 | 1.0 | ... | ... | Do. | Do. | Do. |
| 21 | 29.987 | 29.996 | 101 | 25.0 | 34.0 | 27.2 | 100 | 155 | 117 | 75 | 79 | 83 | N E b E | N E b E | s w b s | 172.50 | 2.0 | ... | ... | Cu. Str. 6. | C. C. Str. 6. | Cirr. 4. |
| 22 | 30.097 | 937 | 29.800 | 24.3 | 40.4 | 27.4 | 101 | 160 | 111 | 79 | 64 | 75 | N E b E | N E b E | N W | 61.60 | 2.5 | ... | ... | Clear. | Clear. | Clear. |
| 23 | 29.650 | 631 | 540 | 27.6 | 33.4 | 32.0 | 123 | 102 | 168 | 82 | 84 | 89 | N E b E | N E b E | N E b E | 161.10 | 4.0 | ... | 1.92 | C. C. Str 8. | Snow. | Snow. |
| 24 | 261 | 344 | 440 | 32.0 | 33.4 | 34.2 | 168 | 162 | 177 | 89 | 84 | 88 | N E b E | s E | s s E | 247.90 | 5.0 | ... | 4.42 | Cu. Str. 10. | Do. | Cu. Str. 10. |
| 25 | 504 | 542 | 640 | 27.6 | 36.2 | 26.1 | 123 | 170 | 105 | 82 | 80 | 75 | E | E | s W | 18.90 | 2.5 | ... | ... | Do. 10. | C. C. Str. 10. | Clear. |
| 26 | 700 | 779 | 900 | 25.1 | 35.2 | 24.3 | 165 | 162 | 111 | 80 | 79 | 86 | s E | s W | s s W | 48.80 | 2.0 | ... | ... | Do. 10. | Cu. Str. 10. | Cu. Str. 10. |
| 27 | 918 | 900 | 803 | 22.4 | 28.9 | 27.1 | 095 | 093 | 111 | 79 | 59 | 75 | E b N | N E b E | N E b E | 104.20 | 2.5 | ... | ... | Do. 10. | Do. | Do. |
| 28 | 774 | 834 | 876 | 30.4 | 35.0 | 28.2 | 142 | 142 | 117 | 84 | 70 | 76 | s E b E | s b E | s W | 135.80 | 3.5 | ... | 1.30 | Snow. | Do. 10. | Do. 4. |
| 29 | 594 | 480 | 560 | 27.0 | 32.0 | 31.1 | 117 | 162 | 135 | 82 | 89 | 89 | E | E S E | s s w | 129.00 | 4.8 | Inap. | 1.64 | Do. | Snow. | Do. 10. |
| 30 | 299 | 548 | 662 | 29.6 | 37.3 | 29.7 | 136 | 164 | 136 | 83 | 76 | 83 | W | s W | s s W | 38.40 | 4.8 | ... | 0.67 | Cirr. Str. 10. | Do. | Do. 10. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ...... | ...... | ...... |

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR OCTOBER, 1861.

| | | |
|---|---|---|
| Barometer | Highest, the 1st day | 30.315 |
| | Lowest, the 30th day | 29.301 |
| | Monthly Mean | 29.876 |
| | Monthly Range | 1.014 |
| Thermometer | Highest, the 17th day | 68°.6 |
| | Lowest, the 22nd day | 26°.2 |
| | Monthly Mean | 46°.64 |
| | Monthly Range | 42°.4 |
| Greatest intensity of the Sun's Rays | | 98°.0 |
| Lowest Point of Terrestrial Radiation | | 24°.0 |
| Amount of evaporation | | 1.17 |
| Mean of Humidity | | .843 |

Rain fell on 16 days, amounting to 5.370 inches; it was raining 69 hours and 30 minutes.

Snow fell on 1 day, inappreciable.

Most prevalent wind, the S. S. E.

Least prevalent wind, the S.

Most windy day, the 20th; mean miles per hour, 17.54.

Least windy day, the 9th; mean miles per hour, 0.01.

Aurora Borealis visible on 5 nights.

First Snow of the Season fell on the 24th day.

The Electrical state of the Atmosphere has indicated moderate intensity.

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR NOVEMBER, 1861.

| | | |
|---|---|---|
| Barometer | Highest, the 2nd day | 30.201 |
| | Lowest, the 29th day | 29.299 |
| | Monthly Mean | 29.714 |
| | Monthly Range | 0.902 |
| Thermometer | Highest, the 4th day | 48°3 |
| | Lowest, the 22nd day | 19°7 |
| | Monthly Mean | 33°60 |
| | Monthly Range | 28°9 |
| Greatest intensity of the Sun's rays | | 77°7 |
| Lowest point of Terrestrial Radiation | | 17°4 |
| Mean of Humidity | | .787 |

Rain fell on 6 days, amounting to 1.023 inches; it was raining 32 hours and 52 minutes.

Snow fell on 8 days, amounting to 11·51 inches; it was snowing 54 hours and 29 minutes.

Most prevalent wind, N. E. by E.

Least prevalent wind, S.

Most windy day, the 3rd day; mean miles per hour, 22.5.

Least windy day, the 12th day; mean miles per hour 0.65.

Aurora Borealis visible on 3 nights.

The Electrical state of the Atmosphere has indicated feeble intensity.

Snow Birds (*Plectrophanes Nivalis*) first seen 17th day.

Imperfect Solar Halo on the 18th day.

Imperfect Lunar Halo on the 10th day.

Crows left here about the 7th day.

# THE
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☞ Communications *to be addressed, henceforth, to* Professor Hincks, *University College, Toronto*—Professor Chapman *relinquishing the General Editorship of the Journal, with the present Number.* (*See* Postscript.)

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THE CANADIAN JOURNAL.

No. XXXVIII.—MARCH, 1862.

NEW SERIES.

# MEAN METEOROLOGICAL RESULTS AT TORONTO, FOR THE YEAR 1861.

BY G. T. KINGSTON, M.A.,
DIRECTOR OF THE MAGNETICAL OBSERVATORY, TORONTO.

*Read before the Canadian Institute, February 22nd,* 1862.

The year 1861, with respect to its temperature, exhibited, as a whole, nothing extraordinary, the mean of the year differing from the average of twenty-two years to the extent of only 0°.10 in excess. The monthly means, moreover, did not differ in a marked degree from the means proper to the several months derived from twenty-two years, the average deviation, without regard to sign, being 2°.24; while the average deviation in the whole period of twenty-two years, and referred to the same standard, was 2°.44. If, however, the *signs* of the deviations be taken into account, it will be seen that the compensations by which the annual mean was maintained, were of the kind that may be styled *unseasonable*, being such as tended to weaken rather than to intensify the distinctive characters of the different parts of the year. Thus, from May to August—comprising the greater part of the year in which the temperature is *above* the yearly mean—the monthly means were relatively *low;* while in February and December, the monthly means were relatively *high*. The depression (3°.9) in the temperature of May, was never exceeded in any May of former years, and was nearly approached only in 1849 and 1851, when in both cases the cold of May was succeeded by unusual warmth in June and July. The abnormal warmth of April served only to aggravate the evil, by hastening the vegetation that was thrown back by the frosts that followed in May. The bad effects of a generally low summer temperature may perhaps be modified, as regards some plants, by occasional bursts of heat, though they be necessarily balanced by unusually low temperatures at other parts of the season. No such mitigating circumstances occurred in 1861, as the warmest day and the absolutely highest temperature of the year were both considerably below the twenty-two years' average of these quantities.

The hygrometric condition of the summer was not favourable; the mean relative humidity of May, June, and July, being 70 against 74, the twenty-one years' average for these months. But as the temperatures were low, the foregoing numbers do not present so strong a contrast as do the tensions of vapour, which for the same three months were ·359 in 1861, and ·393 on the average of twenty-one years. The contrast in this respect between 1860 and 1861, was very conspicuous in May, the tension of vapour for this month being more than 41 per cent. greater in 1860 than in 1861.

May and June were 8 per cent. and 16 per cent. less cloudy than is usual in those months; while later in the season, when a bright sun is more in request, clouds were more than 20 per cent. in excess.

The depth of rain, which on the whole year was three inches in defect, was deficient in June and July to the extent of more than an inch and a half. In May, when rain is an hindrance to gardening and agricultural operations, it was rather in excess; while, as before stated, there was a want of that moisture *in the air* whose presence is favourable to the development of young leaves.

In the following summary, the chief meteorological elements relative to the year 1861, are compared with the average results derived from a series of years, as well as with extreme values that have occurred during the same series:

## TEMPERATURE.

| | 1861. | Average of 22 years. | Extremes in 22 years. | |
|---|---|---|---|---|
| Mean temperature of the year | 44°22 | 44.°12 | 46°.36 (in 1846) | 42°.16 (in 1856.) |
| Warmest month | August. | July. | July 1854 | Aug 1860 |
| when the mean temp. of the month was | 65°.48 | 66°.85 | 72°.47 | 64°.46 |
| Coldest month | January. | February | Jan. 1857 | Feb. 1848 |
| when the mean temp. of the month was | 19°.86 | 22°.98 | 12°.75 | 26°.60 |
| Difference between the warmest and coldest months | 45°.62 | 43°.87 | | |
| Mean of deviations of monthly means, from their respective averages of 22 years, signs of deviation being disregarded | 2°.24 | 2°.44 | 3°.55 (in 1843 and 1857) | 1°.35 (in 1853.) |
| Month of greatest deviation without regard to sign | Decem'r. | January. | Jan. 1857 | |
| when the monthly mean differed from the 22 years' average of the same month by | 5°.0 | 3°.9 | 10°.7 | |
| Warmest day | Aug. 3 | July 20 | July 12 (1845.) | July 31* (1844.) |
| when the mean of the day was | 74°.20 | 77°.28 | 82°32 | 72°.75 |
| Coldest day | Feb. 7 | Jan. 24 | Feb. 6, '55<br>Jan 22 '57 | Dec. 22 (1842.) |
| when the mean of the day was | —7°.7 | —0°.87 | —14°.38 | +9°.57 |
| Highest temperature | 87°.8 | 90°.4 | 99°.2 | 82°.4 |
| which occurred on | June 9 | July 22 | Aug. 24 (1854.) | Aug. 19 (1840.) |
| Lowest temperature | —20°.8 | —12°.3 | —26°.5 | +1°.9 |
| which occurred on | Feb. 8 | Jan. 25 | Jan. 26 (1859.) | Jan. 2 (1842.) |
| Range of the year | 108°.6 | 102°.7 | 118°.2 (in 1855.) | 87°.0 (in 1847.) |

There were twenty-seven days when the mean temperature of the day differed 12° and upwards from the normal mean of the day. Their distribution among the several months may be seen in the following table:

| MONTHS | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| In excess | 0 | 2 | 2 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 6 | 14 |
| In defect | 6 | 2 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 13 |
| Total | 6 | 4 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 8 | 27 |

---

* The mean temperature of the warmest day in the foregoing table, refers to the twenty-two years average of the warmest days in each year, irrespective of their dates, the average date being simply the arithmetic mean of the several dates measured from any fixed epoch. The same remark applies to the coldest day, and to the maxima and minima of the year. As regards the low temperatures, the averages are derived from the coldest days and lowest temperatures in successive *winters*,—December being considered to belong to the following year.

## BAROMETER.

| | 1861. | Average of 18 years. | Extremes in 18 years. | |
|---|---|---|---|---|
| Mean pressure of the year ..... | 29.6008 | 29.6133 | 29.6679 (in 1849.) | 29.5880 (in 1852.) |
| Month of highest pressure .... | December | September | June, 1849 | Sept. 1860 |
| when the mean pressure of the month was ........ | 29.7461 | 29.6629 | 29.8030 | 29.6733 |
| Month of lowest pressure ..... | November | June | March, 1859 | Nov. 1849 |
| when the mean pressure of the month was ........ | 29.5371 | 29.5624 | 29.4215 | 29.5868 |

| | 1861. | Average of 9 years. | Extremes in 9 years. | |
|---|---|---|---|---|
| Maximum pressure of the year.. | 30.330 | 30.372 | 30.552 | 30.245 |
| which occurred ............ | Jan. 22 7 p.m. | —— | Jan. 1855 | Dec. 1854 |
| Minimum pressure of the year.. | 28.644 | 28.592 | 28.286 | 28.849 |
| which occurred ............ | May 6 10 p.m. | —— | March, 1859 | March, 1858 |
| Range of the year............ | 1.686 | 1.780 | 2.106 (in 1859.) | 1.429 (in 1860.) |

There were one hundred and three days when the mean pressure of the day differed 0.200 of an inch and upwards, from the adopted normal mean of the day. Their distribution through the year may be seen from the following table:

| MONTHS | Jan. | Feb. | March. | April. | May. | June. | July. | Aug. | Sept. | Oct. | Nov. | Dec. | Year. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| In excess... | 5 | 4 | 5 | 4 | 5 | 1 | 0 | 3 | 2 | 5 | 3 | 9 | 46 |
| In defect... | 6 | 9 | 7 | 6 | 5 | 1 | 3 | 0 | 4 | 6 | 7 | 3 | 57 |
| Total .... | 11 | 13 | 12 | 10 | 10 | 2 | 3 | 3 | 6 | 11 | 10 | 12 | 103 |

## HUMIDITY.

| | 1861. | Average of 20 years. | Extremes in 20 years. | |
|---|---|---|---|---|
| Mean humidity of the year .... | 78 | 78 | 82, in 1851 | 73, in 1858 |
| Month of greatest humidity.... | January | January | Jan. 1857 | Dec. 1858 |
| when the mean humidity of the month was......... | 88 | 83 | 89 | 81 |
| Month of least humidity....... | May | May | Feb. 1843 | April 1849 |
| when the mean of the month was ................. | 69 | 72 | 58 | 76 |

## CLOUDS.

| | 1861. | Average of 9 years. | Extremes in 9 years. | |
|---|---|---|---|---|
| Mean cloudiness of the year ... | 62 | 60 | 62, in 1861 | 57, in '53 '56 |
| Most cloudy month.......... | February | December | Dec '58<br>Dec. '60<br>Feb. '61 | Dec. 1857 |
| when the mean of the month was .................. | 83 | 75 | 83 | 73 |
| Least cloudy month .......... | June | July & Aug. | July, 1853 | June, 1861 |
| when the mean of the month was .................. | 45 | 45* | 34 | 45* |

## WIND.

| | 1861. | Result of 14 years. | Extremes in 14 years. | |
|---|---|---|---|---|
| Resultant direction.......... | N. 56° W. | N. 60° W. | | |
| Mean resultant velocity in miles | 2.11 | 1.82 | | |
| Mean velocity, without regard to direction ............. | 7.47 | 6.78 | 8.55 in 1860 | 5.10 in 1853 |
| Month of greatest mean velocity | February | March | March, 1860 | Jan. 1848 |
| when the mean velocity was. | 10.58 | 8.60 | 12.41 | 5.82 |
| Month of least mean velocity... | August | July | Aug. 1852 | Sept. 1860 |
| when the mean velocity was. | 4.21 | 4.91 | 3.30 | 5.79 |

## RAIN.

| | 1861. | Average of 21 years. | Extremes in 21 years. | |
|---|---|---|---|---|
| Total depth in the year in inches | 26.995 | 30.324 | 43.555 in 1843 | 21.505 in 1856 |
| No. of days on which rain fell.. | 136 | 106 | 136 in 1861 | 80 in 1841 |
| Greatest depth in one month fell in .................. | November | September | Sept., 1843 | Sept. 1848 |
| when it amounted to ....... | 4.294 | 3.973 | 9.760 | 3.115 |
| Rainy days were most frequent in | September | June | June, 1857 | May, 1841 |
| when their number was..... | 17 | 12 | 21 | 11 |
| Greatest depth of rain on one day | 3.132 | 2.138 | 3.360 | .. |
| which fell on .............. | Nov. 2nd | .. | Oct. 6, 1849 | .. |
| Greatest depth in one hour .... | 0.41 | .. | .. | .. |
| which fell between ....... | 1 & 2 A. M.<br>Aug. 21st | .. | .. | .. |

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* The average minimum of cloudiness in the second column, is the minimum of the twelve monthly means of nine years, and does not always include the lowest months of each year, as these fall differently in different years. This explains why the *highest* minimum in the fourth column should be numerically equal to the minimum on the average of nine years.

The distribution of rain through the day, both as regards depth and frequency, is given in the following Table derived from an hourly rain gauge in operation from April to November inclusive :

| PERIODS ........ | 6 a.m. to 10 a.m. | 10 a.m. to 2 p.m. | 2 p.m. to 6 p.m. | 6 p.m. to 10 p.m. | 10 p.m. to 2 a.m. | 2 a.m. to 6 a.m. | Total. |
|---|---|---|---|---|---|---|---|
| Per centage of depth...... | 9.2 | 12.7 | 22.8 | 23.5 | 17.9 | 13.9 | 100 |
| " " frequency.. | 14.0 | 14.0 | 17.0 | 17.7 | 18.0 | 19.3 | 100 |

SNOW.

|  | 1861. | Average of 19 years & 22 years. | Extremes in 19 years and 22 years. |  |
|---|---|---|---|---|
| Total depth in the year...... | 74.8 | 61.6 | 99.0 in 1855 | 38.4 in 1851 |
| No. of days on which snow fell.. | 76 | 57 | 87 in 1859 | 33 in 1848 |
| Greatest depth in one month fell in .................. | February | February | Feb. 1846 | Dec. 1851 |
| when it amounted to........ | 29.7 | 18.0 | 46.1 | 10.7 |
| Days of snow were most frequent in ................ | January | December | Dec. 1859<br>Jan. 1861 | Feb. 1858 |
| when their number was ..... | 23 | 13.0 | 23.0 | 8 |
| Greatest depth in one day..... | 8 inches | .. | .. | .. |
| which fell on .............. | Feb. 7th | .. | .. | .. |

RAIN AND SNOW (COMBINED.)

*Where* 10 *inches of snow are considered as equivalent to* 1 *inch of rain.*

|  | 1861. | Average of 19 years & 22 years. |
|---|---|---|
| Total depth in the year................................ | 34.475 | 36.488 |
| Number of days in which rain or snow fell............ | 200 | 160* |
| Greatest depth in one month fell in ................... | November | September |
| when it amounted to ............................ | 4.614 | 3.973 |
| Days of aqueous precipitation most frequent in ........ | January | December |
| when their number was.............................. | 23 | 18* |

On February 7th, a heavy snow-storm occurred, accompanied by a strong gale and intense cold. At one part of the day, when the

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* These numbers include the cases in which both rain and snow have fallen in the same day, and which have been reckoned both in the rain and in the snow tables.

# R·THE YEAR 1861.

*West.*

·roximate Elevation above the Sea, 342 Feet.

| | Dec. | Year 1861. | Year 1860. | Year 1859. | Year 1858. | Year 1857. | Year 1856. | Year 1855. |
|---|---|---|---|---|---|---|---|---|
| | ° | ° | ° | ° | ° | ° | ° | ° |
| Mean temp | 31.13 | 44.22 | 44.32 | 44.19 | 44.74 | 42.73 | 42.16 | 43.96 |
| Differenc | - 5.02 | + 0.10 | + 0.20 | + 0.07 | + 0.62 | — 1.39 | — 1.96 | — 0.16 |
| Thermic | - 4.87 | — 6.78 | — 6.68 | — 6.81 | — 6.26 | — 8.27 | — 8.84 | — 7.04 |
| Highest | 55.2 | 87.8 | 88.0 | 88.0 | 90.2 | 88.2 | 96.6 | 92.8 |
| Lowest t | 5.5 | —20.8 | — 8.5 | —26.5 | — 7.3 | —20.1 | —18.7 | —25.4 |
| Monthly | 49.7 | 108.6 | 96.5 | 114.5 | 97.5 | 108.3 | 115.3 | 118.2 |
| Mean ma | 37.03 | ... | ... | ... | ... | ... | ... | ... |
| Mean mi | 24.23 | ... | ... | ... | ... | ... | ... | ... |
| Mean dai | 12.80 | 14.42 | 14.24 | 13.66 | 13.84 | 16.38 | 18.29 | 18.19 |
| Greatest | 26.4 | 33.3 | 30.7 | 39.8 | 31.2 | 37.0 | 44.2 | 39.4 |
| Mean heig | 9.7461 | 29.6008 | 29.5923 | 29.6209 | 29.6267 | 29.6054 | 29.5999 | 29.6249 |
| Differenc | - .0981 | —.0125 | —.0210 | +.0076 | +.0134 | —.0079 | —.0134 | +.0116 |
| Highest l | 30.182 | 30.330 | 30.267 | 30.392 | 30.408 | 30.361 | 30.480 | 30.552 |
| Lowest b | 29.171 | 28.644 | 28.838 | 28.286 | 28.849 | 28.452 | 28.459 | 28.459 |
| Monthly | 1.011 | 1.686 | 1.429 | 2.106 | 1.559 | 1.909 | 2.021 | 2.093 |
| Mean humi | .79 | .78 | .77 | .74 | .73 | .79 | .75 | .77 |
| Mean elasti | .151 | .262 | .260 | .249 | .259 | .254 | .244 | .263 |
| Mean of clo | .62 | .62 | .60 | .61 | .60 | .60 | .57 | .60 |
| Resultant d | 72 W | N 56 W | N 60 W | N 61 W | N 41 W | N 74 W | N 71 W | N 62 W |
| " v | 3.50 | 2.11 | 3.32 | 2.24 | 1.59 | 2.54 | 3.03 | 2.51 |
| Mean veloci | 7.96 | 7.47 | 8.55 | 8.17 | 7.64 | 7.99 | 8.31 | 8.14 |
| Difference | -0.22 | +0.70 | +1.78 | +1.40 | +0.87 | +1.22 | +1.54 | +1.37 |
| Total amou | 0.560 | 26.995 | 23.434 | 33.274 | 28.051 | 33.205 | 21.505 | 31.650 |
| Difference | -0.985 | —3.329 | —6.890 | +2.950 | —2.273 | +2.881 | —8.819 | +1.326 |
| Number o | 6 | 136 | 130 | 127 | 131 | 134 | 99 | 103 |
| Total amour | 6.8 | 74.8 | 45.6 | 64.9 | 45.4 | 73.8 | 65.5 | 99.0 |
| Difference | - 7.86 | +13.17 | —16.03 | + 3.27 | —16.23 | +12.17 | + 3.87 | +37.37 |
| Number o | 8 | 76 | 75 | 87 | 67 | 79 | 69 | 64 |
| Number of | 17 | 165 | 174 | 169 | 178 | 171 | 198 | 198 |
| Number of | 4 | 43 | 58 | 53 | 59 | 26 | 35 | 46 |
| Possible to s | 16 | 180 | 190 | 199 | 198 | 189 | 212 | 204 |
| Number of t | 0 | 27 | 30 | 30 | 19 | 28 | 25 | 38 |

temperature was 14°.3 below zero, the wind was blowing more than 33 miles an hour, with heavy falling and drifting snow. The temperature afterwards fell to 20.°8 below zero, but at that time the gale had subsided.

he accompanying table is a general abstract of the meteorological observations made at the Magnetic Observatory, Toronto, during the year 1861.

# AN ATTEMPT AT A NEW THEORY OF HUMAN EMOTIONS.

BY WILLIAM HINCKS, F.L.S., ETC.,
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In a paper laid before the Canadian Institute on a former occasion, (*Journal*, Vol. IV., p. 396), I offered some explanation and defence of the Sensationalist Philosophy in relation to the human mind and its operations, which, altogether rejecting innate ideas and instinctive forms of thought, regards the first sensation as the commencement of its enquiries, and endeavours to ascertain the connection of mental states with the physical frame, and the laws according to which they combine and succeed one another. The grand fundamental law, called the law of association, is considered as sufficient to explain all the various intellectual states of which our nature is susceptible; and, according to Hartley, this law depends on *physical sympathy* between different portions of nervous matter acted upon simultaneously or in immediate succession. Assuming that the law of association has been well expounded by Hartley Brown and James Mill, and that Hartley has given, to say the least, an intelligible and highly probable explanation of its origin, I now propose to extend the application of the same principle so as to offer a consistent and rational explanation of the emotional part of our nature, of the real difference between intellectual states and emotions, and of the common relation between the various passions to which our nature is subject.

Writers on the *emotions, passions,* or *active powers*, have often given a long list of what they suppose to be different and independent simple mental states, incapable of definition, and only to be known by

# GENERAL METEOROLOGICAL REGISTER FOR THE YEAR 1861.

*Provincial Magnetical Observatory, Toronto, Canada West.*

LATITUDE, 43° 39′ 4″ North; LONGITUDE, 5h. 17m. 33s. West.—Elevation above Lake Ontario, 108 Feet; approximate Elevation above the Sea, 342 Feet.

| | JAN. | FEB. | MAR. | APR. | MAY. | JUN. | JUL. | AUG. | SEPT. | OCT. | NOV. | DEC. | Year 1861. | Year 1860. | Year 1859. | Year 1858. | Year 1857. | Year 1856. | Year 1855. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean temperature | 19°.86 | 26°.06 | 26°.92 | 42°.02 | 47°.50 | 61°.29 | 65°.37 | 65°.48 | 59°.07 | 48°.74 | 37°.14 | 31°.13 | 44°.22 | 44°.32 | 44°.19 | 44°.74 | 42°.73 | 42°.16 | 43°.96 |
| Difference from average (22 years) | − 3.67 | + 3.08 | − 3.21 | + 1.04 | − 3.89 | − 1.07 | − 1.48 | − 0.54 | + 1.16 | + 3.22 | + 0.45 | + 5.02 | + 0.10 | + 0.20 | + 0.07 | + 0.62 | − 1.39 | − 1.96 | − 0.16 |
| Thermic anomaly (Lat. 43° 40′ N.) | −12.94 | − 8.64 | −13.18 | − 8.18 | −10.60 | − 3.31 | − 3.33 | − 3.02 | − 2.43 | − 5.06 | − 6.06 | − 4.87 | − 6.78 | − 6.68 | − 6.81 | − 6.26 | − 8.27 | − 8.84 | − 7.04 |
| Highest temperature | 37.0 | 46.0 | 47.4 | 67.0 | 73.0 | 87.8 | 84 5 | 85.2 | 78.8 | 71.0 | 52.4 | 55.2 | 87.8 | 88.0 | 88.0 | 90 2 | 88.2 | 96.6 | 92.8 |
| Lowest temperature | −11.2 | −20.8 | − 5.2 | 23.8 | 28.0 | 41.6 | 47.0 | 47.0 | 37.1 | 29.0 | 23.0 | 5.5 | −20.8 | −- 8.5 | −26.5 | − 7.3 | −20.1 | −18.7 | −25.4 |
| Monthly and annual ranges | 48.2 | 66.8 | 52.6 | 43.2 | 45.0 | 46.2 | 37.5 | 38.2 | 41.7 | 42.0 | 29.4 | 49.7 | 108.6 | 96.5 | 114.5 | 97.5 | 108.3 | 115.3 | 118.2 |
| Mean maximum temperature | 25.14 | 32.37 | 33.53 | 49.71 | 55.69 | 70.36 | 74.67 | 74.30 | 66.38 | 55.34 | 42.39 | 37.03 | ... | ... | ... | ... | ... | ... | ... |
| Mean minimum temperature | 13.93 | 18.54 | 20.71 | 35.35 | 40.04 | 51.26 | 56.23 | 58.15 | 51.80 | 41.62 | 31.99 | 24.23 | ... | ... | ... | ... | ... | ... | ... |
| Mean daily range | 11.21 | 13.83 | 12.82 | 14.36 | 15.65 | 19.11 | 18.44 | 16.16 | 14.58 | 13.73 | 10.40 | 12.80 | 14.42 | 14.24 | 13.66 | 13.84 | 16.38 | 18.29 | 18.19 |
| Greatest daily range | 25.2 | 32.4 | 33.3 | 28.8 | 28.4 | 29.5 | 29.1 | 25.0 | 24.0 | 31.9 | 20.4 | 26.4 | 33.3 | 30.7 | 39 8 | 31.2 | 37.0 | 44.2 | 39.4 |
| Mean height of barometer | 29.6517 | 29.5441 | 29.6206 | 29.5640 | 29.5454 | 29.5698 | 29.5505 | 29.6530 | 29.6084 | 29.6191 | 29.5371 | 29.7461 | 29.6008 | 29.5923 | 29.6209 | 29.6267 | 29.6054 | 29.5999 | 29.6249 |
| Difference from average (18 years) | +.0183 | —.0681 | +.0383 | —.0230 | —.0392 | +.0074 | —.0509 | +.0317 | —.0545 | —.0309 | —.0768 | +.0981 | —.0125 | —.0210 | +.0076 | +.0134 | - .0079 | —.0134 | +.0116 |
| Highest barometer | 30.330 | 30.144 | 30.200 | 30.120 | 29.955 | 29.810 | 29.830 | 29.902 | 30.104 | 30.054 | 30.000 | 30 182 | 30.330 | 30.267 | 30.392 | 30.408 | 30.361 | 30.480 | 30.552 |
| Lowest barometer | 29.006 | 28.979 | 29.034 | 29.055 | 28.644 | 29.176 | 29.269 | 29.382 | 29.076 | 28.998 | 29.005 | 29.171 | 28.644 | 28.838 | 28.286 | 28.849 | 28.452 | 28.459 | 28.459 |
| Monthly and annual ranges | 1.324 | 1.165 | 1.166 | 1.065 | 1.311 | 0.634 | 0.561 | 0.520 | 1 028 | 1.056 | 0.995 | 1.011 | 1.686 | 1.429 | 2.106 | 1.559 | 1.909 | 2.021 | 2.093 |
| Mean humidity of the air | .88 | .84 | .80 | .73 | .69 | .69 | .73 | .78 | .79 | .82 | .79 | .79 | .78 | .77 | .74 | .73 | .79 | .75 | .77 |
| Mean elasticity of aqueous vapour | .102 | .130 | .127 | .199 | .232 | .377 | .467 | .495 | .400 | .292 | .178 | .151 | .262 | .260 | .249 | .259 | .254 | .244 | .263 |
| Mean of cloudiness | .76 | .83 | .62 | .61 | .49 | .45 | .56 | .54 | .60 | .61 | .74 | .62 | .62 | .60 | .61 | .60 | .60 | .57 | .60 |
| Resultant direction of the wind | N 86 W | N 77 W | N 54 W | N 37 E | N 47 W | N 39 W | N 74 W | N 8 E | N 71 W | N 61 W | N 46 W | N 72 W | N 56 W | N 60 W | N 61 W | N 41 W | N 74 W | N 71 W | N 62 W |
| " velocity of the wind | 2.92 | 3.86 | 4.33 | 2.31 | 3.60 | 2.29 | 1.43 | 0.46 | 1.39 | 1.06 | 1.94 | 3.50 | 2.11 | 3.32 | 2.24 | 1.59 | 2.54 | 3.03 | 2.51 |
| Mean velocity (miles per hour) | 9.30 | 10.58 | 10.56 | 8.90 | 9.17 | 6.11 | 4.66 | 4.21 | 4.81 | 5.96 | 7.44 | 7.96 | 7.47 | 8.55 | 8.17 | 7.64 | 7.99 | 8.31 | 8.14 |
| Difference from average (14 years) | +1.44 | +2.50 | +1.96 | +1.03 | +2.55 | +0.84 | −0.25 | −0.96 | −0.59 | +0.10 | −0.05 | −0.22 | +0.70 | +1.78 | +1.40 | +0.87 | +1.22 | +1.54 | +1.37 |
| Total amount of rain | 0.685 | 0.815 | 2.125 | 1.619 | 3.380 | 2.329 | 2.635 | 2.953 | 3.607 | 1.993 | 4.294 | 0.560 | 26.995 | 23.434 | 33.274 | 28.051 | 33.205 | 21.505 | 31.650 |
| Difference from average (21 & 22 yrs ) | −0.722 | −0.231 | +0.577 | −0.779 | +0.139 | −0.771 | −0.855 | +0.002 | −0.366 | −0.492 | +1.154 | −0.985 | −3.329 | −6.890 | +2.950 | −2.273 | +2.881 | −8.819 | +1.326 |
| Number of days rain | 4 | 4 | 8 | 12 | 12 | 13 | 16 | 15 | 17 | 15 | 14 | 6 | 136 | 130 | 127 | 131 | 134 | 99 | 103 |
| Total amount of snow | 20.6 | 29.7 | 7.1 | 6.9 | 0.5 | ... | ... | ... | ... | Inapp. | 3.2 | 6.8 | 74.8 | 45.6 | 64.9 | 45.4 | 73.8 | 65.5 | 99.0 |
| Difference from average (19 years) | + 6.97 | +11.67 | − 1.67 | + 4.39 | + 0.40 | ... | ... | ... | ... | − 0.84 | + 0.10 | − 7.86 | +13.17 | −16.03 | + 3.27 | −16.23 | +12.17 | + 3.87 | +37.37 |
| Number of days snow | 23 | 17 | 14 | 4 | 1 | ... | ... | ... | ... | 1 | 8 | 8 | 76 | 75 | 87 | 67 | 79 | 69 | 64 |
| Number of fair days | 8 | 9 | 11 | 16 | 18 | 17 | 15 | 16 | 13 | 15 | 10 | 17 | 165 | 174 | 169 | 178 | 171 | 198 | 198 |
| Number of auroras observed | 0 | 3 | 6 | 6 | 5 | 2 | 1 | 4 | 5 | 6 | 1 | 4 | 43 | 58 | 53 | 59 | 26 | 35 | 46 |
| Possible to see aurora (No. of nights) | 9 | 8 | 16 | 17 | 18 | 18 | 17 | 17 | 16 | 17 | 11 | 16 | 180 | 190 | 199 | 198 | 189 | 212 | 204 |
| Number of thunderstorms | 0 | 0 | 1 | 4 | 3 | 3 | 8 | 6 | 2 | 0 | 0 | 0 | 27 | 30 | 30 | 19 | 28 | 25 | 38 |

being experienced or by observing their effects, but perceived to have such a general resemblance as properly to be referred to one class. These they have classified in what seemed to them a convenient manner with a view to considering their influences on our condition, and their moral qualities. Others have endeavoured by analysis to lessen the number of primary passions or emotions, shewing how different names really express the same emotion excited under somewhat different circumstances. With these I agree so entirely that I would carry out their principle to the utmost by admitting only an emotion belonging to pleasure and one belonging to pain, and defining all the others by naming one of these, and pointing to the kind of objects or the condition of things around us in which the peculiar form appears. Such analytical view of the nature and relations of the various emotions would form no unimportant part of a treatise on this branch of the philosophy of mind, but need not be examined in detail in the present connection. There is a very general agreement among philosophers that emotions, passions, or active powers differ essentially in nature from intellectual states, and are felt to have something common to them all as a class, in whatever degree they may differ from each other. This is not indeed a universal sentiment, for both Hartley and James Mill suppose that by due regard to the character of our sensations as pleasurable and painful, and a proper application of the law of association, all the varieties of emotions may be fully explained. I cannot help thinking, however, that the general feeling of those who reflect on the subject is that there is a real well marked difference between intellectual states and emotions, and fully admitting that this difference depends on pleasure and pain as actual sensations, or as ideas intermingling with sensations, I think it desirable, if possible, to ascertain the exact nature and causes of the phenomena. All sensations are commonly said to be pleasurable, painful, or indifferent. The truth seems to be, that every sensation, if not too intense—in which case it becomes painful—is naturally, before it has been affected by frequent repetition, a source of pleasure. Those which we describe as indifferent are such as we have frequent occasion to experience, which causes them to be familiar, and as are not now impressed with any peculiar vividness. The sensation which causes pleasure is either novel or unusually vivid, and if its vividness be in excess it becomes a pain. Thus pleasures repeated become indifferent, scarcely receiving from the mind any notice, whilst a pleasurable sensation increased in intensity becomes painful, and a pain moderated may fall within the limits of pleasure. If we fix our attention on any single distinct pleasurable sensation, we shall observe that as it increases in intensity it is no longer confined to the nerve or organ in which it is excited, but by the inherent sympathy of like parts of our frame, diffuses itself so as to produce a general feeling of pleasure, a state distinguishable from, though dependent upon, the single pleasurable sensation. It is manifest that according to the supposed physical origin of the law of association in coexistent or immediately successive states acquiring sympathetic power each to revive the other, that ideas of pleasures and pains would be revived like any other past states, and that they would be equally revived in their *diffused state* as if they had remained perfectly simple. All those states, then, which are called the active powers, or the passions, but which I prefer describing as a general name by the term emotions, are, I conceive, correctly described as diffused pleasures or pains, present, or their ideas revived by association, and arising in various circumstances and in connection with various objects. The peculiar characteristic feeling which has caused most philosophers and mankind generally to distinguish these from purely intellectual states, consists in sympathetically diffused pleasure or pain, and consequently has a physical origin in close relation to that of the law of association itself. There is really only one pleasurable and one painful emotion, both arising in the same way ; but it is highly convenient to have a number of names, inconsiderately regarded as implying the essential distinctness of the states, for the primary emotions separately excited by the presence or anticipation of various good and evil, or mingled together, as I believe them to be in some important instances. Thus the idea of any object or condition regarded as a cause of pleasure is attended by pleasing emotions which, if the object or condition be not immediately attainable, is mingled with painful emotions occasioned by privation of it, and this mixture constitutes *desire*. In the same way every other emotion respecting an unattainable good, whether as entirely beyond our own reach, or as possessed by another whilst we are deprived of it, is really of a mixed character. We can hardly be said to have any distinctive name applicable to those simple emotions of pleasure and pain, which are the elements of all this class of mental states, no doubt because, excepting in philosophical discussions, we have no occasion to make them the subject of discourse except when the excitement is considerable. *Joy,* which means pleasurable emotion arising from the actual possession or immediate anticipation of good, with its direct contrast *grief,* are the simplest emotions for which we have names. If the pleasure or pain be actually present, and referable to a specific part of our frame, especially if its too great vividness does not confuse our perceptions, the transition from actual sense of pleasure or pain to pleasing or painful emotions is very perceptible. If the satisfaction is derived from the acquired command of the means of pleasure, the emotion depends on such complex associations that its nature is not discerned with any peculiar facility. Love expresses the simple pleasurable emotion, so associated with an object or person that has frequently excited it, or is believed capable of exciting it, as to be very readily called up by the presence, name, or recollection of that object or person. Gratitude, again, is the name we employ to express the same simple, pleasing emotion, strongly excited in connection with specific benefits received from an intelligent agent, with the corresponding desire of conferring pleasure on the object of our gratitude. We will add the analysis of a still more complex state belonging to this class, to which our attention is naturally led by the examples already brought forward. I refer to the filial affection. Scarcely any one would pretend that this is a simple emotion. Every thing which belongs to it is fully expressed by describing it as made up of love, gratitude, confidence, and reverence. We have seen the nature of the two former: confidence is the feeling with which an inferior and dependent looks up to a superior and controlling being, in whose knowledge of what is really good and desire to bestow it experience has taught him to trust. Reverence is only a certain amount of fear, the simple painful emotion associated with an object which has caused restraint, disappointment, or suffering of any kind, intermingled with the other emotions already named as entering into the filial feeling. We might in this manner examine any of the various emotions attributed to human beings, and we should find them all to be the emotion belonging to pleasure or to pain excited in certain circumstances, or the two intermingled in such a manner that convenience dictates the use for them of separate names, but I have also endeavoured to shew in what manner a mere pleasure or pain passes from the condition of a sensation to an emotion by its sympathetic diffusion so as to belong no longer to a particular nerve or organ, but to our frame generally. We have thus the elements of a complete theory of human emotions, connecting itself naturally and easily with the theory of the intellectual powers, to which I have given in my adhesion, and of which, on a previous occasion, I sketched the evidence. The subject would admit both of detailed analyses of the various emotions which have been treated as simple independent mental states, and of copious illustrations of the effects of the views I have proposed, but if thus treated it would require a volume. On an occasion like the present it may suffice to indicate the effect or tendency of the views proposed, so as fairly to submit them to the judgment of inquirers. It will be seen that I rely first on the principle that all sound philosophy of the human mind has its foundation in a proper attention to the connection of the mind with the physical frame. This is a subject necessarily involving much mystery; yet it is well ascertained that all mental changes belong to the nervous system, and are dependent upon nervous action. The fact that states simultaneously existing, whether as sensations or as ideas and whether simple or complex, acquire the power of reviving each other when one of them is brought up again, is certainly established by experience. The explanation that this fact depends on what we call sympathy in the nervous matter being a property of its nature is, perhaps it is not too much to say, the only conceivable one; and assuming this property, the power of vivid mental states like pleasures and pains to extend their influence beyond the nerves in which they were excited to the whole frame is a natural consequence, whilst this diffusion of pleasure and pain exactly corresponds with the best notion we can form of emotion as distinguished from sensation or intellectual state. But I beg it may be observed to what extent this explanation, if worth anything, must go. It relates not to any single emotion of our nature, but to the whole, in all their variety. It equally explains what are termed affections—that is, permanent tendencies under certain circumstances to the prevalence and influence of certain emotions moderately excited—and of the strongest passions. It traces them all to the influence, direct or indirect, of pleasure and pain, thus shewing the great moving principle of the active part of our nature, and putting us in the proper track for discovering how it can be best regulated. It is commonly believed that moral sentiments constitute a distinct class, arising instinctively and independently, but the theory I have proposed applies to them equally with the other emotions, and their analysis is as easy as that of most others. I might hence attempt to draw conclusions respecting disputed points in the theory of morals, but I have already gone as far as my present purpose requires, and must submit these speculations to your candid judgment. The Sensationalist Philosophy has not of late years had any fair chance of being examined, with a proper appreciation of its evidence, by students of this branch of science, because the most opposite doctrines have prevailed in the schools, and those who have undertaken to give general information, saving the trouble of consulting the original writers, have, writing in the spirit of an opposed system, and viewing everything in its light, grossly perverted and misrepresented both the evidence and the tendency of our views. I entertain a strong confidence that this state of things will in the progress of time remedy itself. Some free spirits will find their way to the sources of information. Arbitrary assumptions and bold assertions will not always be submissively accepted. The plan of declaring that to be simple which we have not taken the pains or possessed the ingenuity to analyse, will not always be accepted as satisfactory. The philosophy of mind is as truly as any other an inductive science, but in its earlier stages of progress (and it is naturally a science of slow growth) it is peculiarly liable to suffer from false theories, and the influence accidentally acquired by the Scotch and German Schools has for a time almost overborne opposition to their dogmas. I am content to record the results of my own inquiries, and to leave it to the future to decide on the real merits of antagonistic systems.

# A POPULAR EXPOSITION OF THE MINERALS AND GEOLOGY OF CANADA.

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## PART IV.

*(Continued from Vol. VI. page 518.)*

*Molluscous Animals.*—The forms of the sub-kingdom MOLLUSCA may be arranged under the following groups and classes:—*A. Coralliform Mollusca:* 1, BRYOZOA. *B. Acephalous* (*or headless*) *Mollusca:* 2, TUNICATA, (no fossil representatives); 3, BRACHIOPODA; 4, LAMELLIBRANCHIATA. *C. Encephalous Mollusca*: 5, PTEROPODA; 6, HETEROPODA; 7, GASTEROPODA; 8, CEPHALOPODA.

BRYOZOA.—The bryozoons (so named from the general moss-like aspect of their united cells) are minute animals of marine existence. They form cell-colonies after the manner of most coral animals, but present a higher organization than these latter. They possess a distinct oral and anal cavity, and assimilate in many other respects to the molluscous type. The compound cell-structure in some forms takes the shape of leaf-like expansions, and in others is either dendritic, plumose, rounded, or irregular. It is also either free, or attached by growth to shells and other sub-marine bodies.

Modern bryozoons abound in all seas. Fossil forms of this class are also exceedingly numerous, ranging throughout the entire series of fossiliferous rocks. Their separation from corals is in many instances, however, a task of much perplexity; and, as those found in our Canadian strata are of little importance as test-forms, we confine our illustrations to a single example, *Fenestella elegans*, (Fig. 87), from the Niagara Group of the Upper Silurian Series. Representatives of the class, it may be observed, occur as low down as the Calciferous-Sand-Rock (see PART V.); and Professor Dawson, on the other hand, has found a number of species identical with existing forms, in the Post-tertiary deposits of Eastern Canada. These are described in the 4th volume of the *Canadian Naturalist.*

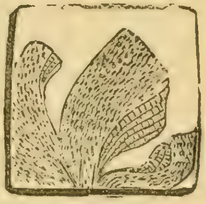

Fig. 87.

The *Graptolites,* already described as a section of the POLYPIFERA or CORALS, (see Vol. VI., p. 503) are referred by some palæontologists to the present class.

BRACHIOPODA.—The brachiopods are marine, headless mollusks, provided with a bivalve shell. The valves of this shell are always of unequal size; and one is situated on the dorsal, and the other on the ventral side of the animal. The ventral valve is almost invariably the larger of the two, and without reference to the anatomy of the mollusk would be naturally taken for the dorsal valve. The valves, though unequal in size, are "equilateral"—*i. e.*, a vertical line drawn straight through the middle of each valve, divides the shell into two exactly equal parts. This serves to distinguish at a glance a brachiopod shell from the shells of other bivalves: or at least from the great majority of these, as some few, the *Pectens* for example, have nearly equilateral shells. A depression or "sinus" frequently occurs down the centre of one valve, and a corresponding projection or "mesial fold" down the centre of the other. The sinus is almost invariably on the ventral, and the fold on the dorsal valve. The pointed upper extremity of the valve, is technically known as the "beak." In some forms the valves are close together; but in others, a closed space (often striated across) occurs between the two. This is called the "area." See Fig. 88 and accompanying explanation. In the centre of the area, or under the beak of the ventral valve, there is frequently (as in the *spirifers*, &c.,) a triangular or circular orifice, the "foramen." This opening, in the species which possessed it, served for the passage of the pedicel by which the animal was attached to the sea-bottom. The foramen is situated, at other times, upon, or near to, the ventral beak, as in *spirigera*, &c. In many species again, it appears to have become closed by age; and in others, it is altogether absent. The line of junction between the upper part of the valves is termed the hinge-line. It is straight in some genera, (*Orthis*, *Strophomena*, *Spirifer*, for example,) and arched or curved in others, (*Athyris*, *Rhynconella*, *Pentamerus*, *Terebratula*, etc.) In many brachiopods, the shell is traversed by minute pores or tubular prolongations. When this is the case, the shell is said to be "punctate;" and when the pores are absent, it is termed "impunctate."

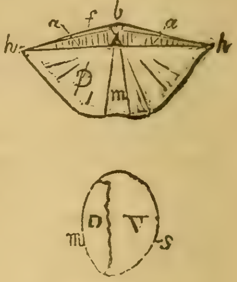

Fig. 88.*

The brachiopods possess, as their chief characteristic, a pair of long fleshy "arms," covered with delicate cilia, and either entirely confined in a coil within the shell, or capable of protrusion to a certain extent. In some genera, the inside of the dorsal valve carries peculiar spiral processes, or a shelly loop or other calcareous framework, for he support of these arms. A support of this kind is however wanting in many genera, or is otherwise merely rudimentary. The brachiopods differ essentially from the lammellibranchiate bivalves in the non-possession of distinct branchiæ or breathing gills. In existing seas the brachiopods are comparatively rare, the number of known species not exceeding fifty; whilst the fossil species discovered up to the present time, amount to over thirteen or fourteen hundred. They constitute moreover, at least ninety per cent. of the bivalve shells met with in the lower fossiliferous rocks.

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* *D*=dorsal valve. *V*=ventral valve. *a*, area; *b*, beak of ventral valve; *f*, foramen; *h*-*h*, the hinge line; *m*, position of mesial fold; *s*, position of mesial sinus.

The following are the more important genera of Canadian occurence: *Lingula, Orthis, Strophomena, Leptæna, Spirifer. Athyris, Spirigera, Atrypa, Rhynconella, Pentamerus, and Stricklandia.*

*Lingula* :--Shell : horny, thin, oblong, and nearly equivalve. Black and shining in our examples, and consisting largely (as first shewn by Prof. Sterry Hunt), of phosphate of lime. No internal calcareous appendages. This genus ranges from the Lower Silurian epoch into the present or existing period. Numerous species occur in our Silurian formations. *L. quadrata*, fig. 89, from the Trenton Limestone, Utica Slate, and Hudson River Group (Lower Silurian,) may be cited as a common example.

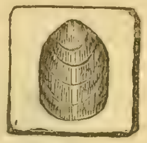
Fig. 89.

*Orthis* :—Shell calcareous. Bi-convex or plano-convex; with straight hinge-line, and punctate surface No internal supports, properly so-called. This genus ranged throughout the Palæozoic age, but was most abundant during the Silurian and Devonian periods. The species have usually a more or less circular outline, with the surface of the shell marked by fine or course radiating lines.

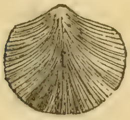
Fig. 90.

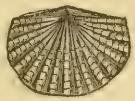
Fig. 91.

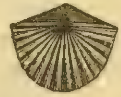
Fig. 92.

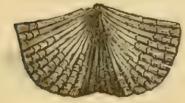
Fig. 93.

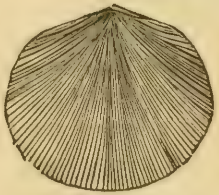
Fig. 94.

Canadian examples are exceedingly numerous; more especially those belonging to *O. testudinaria*, fig. 90, of the Trenton and higher divisions of the Lower Silurian series. Fig. 91 represents *O. trice-*

*naria*; fig. 92, *O. pectinella,* and fig. 93, *O. lynx,* all of common occurrence in the Trenton Group. *O. elegantula* of the Niagara Group (Upper Silurian) is closely related to *O. testudinaria*, and has the general form of fig. 90. *O. Vanuxemi,* fig. 94, is a Devonian species. The Lower Silurian form, *O. lynx,* fig. 93, has the general aspect of a spirifer, but its mesial fold and sinus are marked by several plications, a character not exhibited by any of our Canadian Spirifers. It was formerly called *Delthyris lynx.*

*Strophomena*:—Shell, concavo-convex; hinge-line, straight; no internal supports. This genus ranges from the Silurian to the Carboniferous formation. Canadian examples are very abundant.

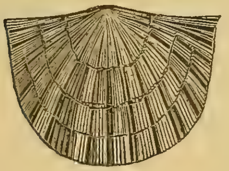

Fig. 95.

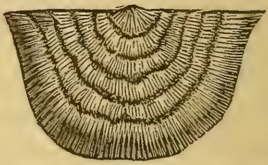

Fig. 96.

Fig. 95 represents *S. alternata,* a species of exceedingly common occurrence in the Trenton and Hudson River Groups (Lower Silurian.) *S. filitexta* is a closely related form. Fig. 96 exhibits another well-known species, *S. rhomboidalis* (=*Strophomena* and *Leptæna depressa,*) from the Niagara Group and other Upper Silurian strata, and also from the Devonian rocks of Western Canada. In these latter rocks a few species of *Chonetes* and *Productus,* (genera allied to *Strophomena,*) also occur.

*Leptæna*:—This genus (or rather sub-genus,) merely differs from *Strophomena* by the character and elongation of its muscular impressions. *L. sericea,* Fig. 97, of the Trenton and Hudson River Groups, is a species of common occurrence.

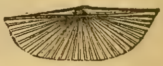

Fig. 97.

*Spirifer*:—Shell with internal calcareous processes in the form of two spiral coils pointing outwards. Hinge-line straight, long; area well developed, with triangular foramen. The genus ranges from the Silurian to the Triassic (or Jurassic) epoch, but is chiefly characteristic of Upper Silurian, Devonian, and Carboniferous rocks. Fig. 98 represents *S. Niagarensis* of the Upper Silurian, and Fig. 99, *S.*

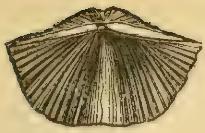

Fig. 98.

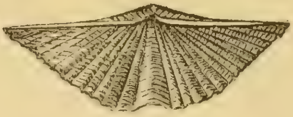

Fig. 99.

*mucronatus* of the Devonian series. Both are of common occurrence. The hinge-line of the latter is sometimes shorter (as compared with the height of the shell,) than is shewn in the figure. In our Western Devonian rocks, several other species occur: as *S. duodenarius*, with eight or nine rounded ribs on each side of the mesial fold; *S. raricostatus*, with two or three coarse plications on each side of the fold; *S. gregaria*, a small species, &c. These are figured and described by Mr. Billings in the *Canadian Journal*, vol. VI. Another common species of the Upper Silurian series, is *S. radiatus*. This differs chiefly from *S. Niagarensis* by its finer and more numerous plications. A third Niagara species *S. sulcatus*, has about eight plications on each side of the mesial fold, crossed by the rough and strongly-pronounced edges of the layers of growth.

*Athyris*:—The shell in this genus has internal spires as in *Spirifer*, but the hinge-line is curved, and the area is absent or rudimentary. Species range from the Silurian to the Triassic formations. Several occur in our Devonian rocks. One of the most common of these, *A. clara*, (Billings,) is represented in fig. 100. *A. Maia* is a somewhat similar species, but with a more developed or longer mesial fold and sinus, and with a slight space or false area between the beaks. These and other Devonian species are described in detail by Mr. Billings, in the *Canadian Journal*, Vol. V.

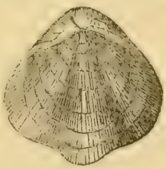

Fig. 100

*Spirigera*:—This genus or sub-genus differs from *Athyris* in having a perforation or foramen in the beak of the ventral valve. *S. concentrica* of the Devonian rocks is shewn in fig. 101. The genus *Retzia* is nearly allied to *Spirigera*, but the shells are smaller and strongly ribbed.

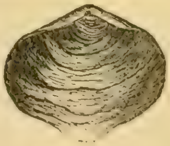

Fig. 101.

*Atrypa* :—A good deal of uncertainty still prevails with regard to the proper limitation of this genus. In outward form it agrees with Rhynconella, see below, but appears to possess internal calcareous spires, the points of which extend into the hollow of the smaller or dorsal valve. Fig. 102 represents an exceedingly common species, *A. reticularis*, of the Upper Silurian and Devonian strata, but chiefly characteristic of the latter.

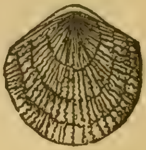

Fig. 102.

*Rhynconella* :—Shell, in general, strongly bi-convex. Hinge-line, curved; no area. No internal spires, but in the living species the arms are coiled spirally, the spires pointing downwards and inwards. The genus ranges from the Lower Silurian into the existing epoch. Fig. 103 represents a small form, *R. plena*, very common in the Chazy limestone of the Trenton Group, (Lower Silurian); and fig. 105, *R. increbescens*, a closely related species occurring abundantly throughout the Trenton limestone. In this latter species, the plications on the shell are crossed by well-marked imbricating lines of growth. Numerous examples of this genus occur also in our Upper Silurian and Devonian strata. A modern species, found in the Post-Tertiary deposits of Eastern Canada, *R. psittacea*, is figured in the woodcut 105.

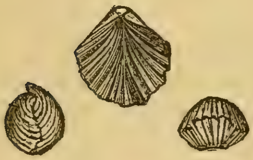

Fig. 103.

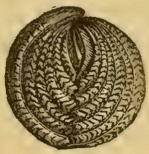

Fig. 104.

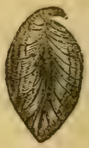

Fig. 105.

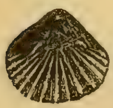

Fig. 106.

Fig. 106 is a representation of the old *Rhynconella hemiplicata* of the Trenton Group, now referred by Mr. Billings to his new genus *Camerella*. It is characterized by a few broad plications on the lower part of the shell.

*Pentamerus* :—In this genus, the shell is prominently bi-convex, with arched hinge-line and large incurved beak. Internally it is divided by septa into several chambers. The genus ranges from the Silurian to the Carboniferous formations. *P. oblongus*, of the Niagara Group, is represented in fig. 107, the sketch 107 *a* shewing a ventral view of the internal cast. *P. aratus*, of the Devonian rocks, is figured in 108. This latter form is closely related to the well-known typical species *P. galeatus*.

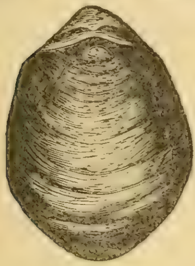

Fig. 107.

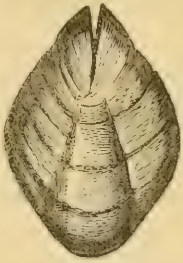

Fig. 107 *a*.

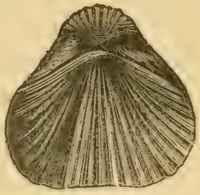

Fig. 108.

*Stricklandia* :—This genus has been recently established by Mr. Billings. It includes certain more or less oval forms with nearly equal valves, formerly referred to *Pentamerus*. *S. elongata*, a Devonian species, is shewn in fig. 109. Other species occur in these and in the Upper Silurian rocks.

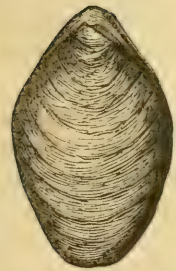

Fig. 109.

Our Canadian formations do not appear, as yet, to have offered any examples of the well-known genera, *Crania*, *Calceola*, and *Terrebratula*.

LAMELLIBRANCHIATA (or CONCHIFERA.)—Lamellibranchiate mollusks are marine or fresh-water animals of the acephalous type. They are provided in the adult condition with laminated gills or branchiæ for breathing purposes, (as seen, for example, in the so-called " beard " of the oyster,) and they secrete a bi-valve external shell. The two valves in most genera (those of the *Ostreidæ* and some *Aviculidæ* are the only exceptions) are of equal size, but always more or less inequilateral. (See under the Brachiopods above). These mollusks are exceedingly abundant in the fossil state, though less numerous than the brachiopods in the older rock formations. The known species obtained from the seas, lakes, and rivers, of existing nature, somewhat exceed three thousand, whilst nearly double that number of fossil species have been recognized. These latter, however, belong it must be remembered, not to one period, but to many successive epochs; although on the other hand, it is manifest that we see in them merely an incomplete record of the lamellibranchiate fauna of the Past.

In their classification, the lamellibranchiate mollusks fall into two leading sections and four groups, as follows:

- (1) ASIPHONIDA
  - (1 *a*) *Pleuroconcha.*
  - (1 *b*) *Orthoconcha.*
- (2) SIPHONIDA
  - (2 *a*) *Integro-Pallialia.*
  - (2 *b*) *Sinu-Pallialia.*

The animals of the first section are without the peculiar respiratory tubes possessed by the SIPHONIDA. These latter, for example, have a pair of short or long siphonal tubes, which assist in the process of respiration, and which admit in the *Sinu-pallialia* of extension beyond the shell.

The *Pleuroconcha*, (group 1), of which the oyster may be taken as a type, rest in their natural position with one valve *below*, and the other *above*, and thus approximate to the Brachiopods. They have in general but one large muscular impression in the centre of the inside of each valve. This forms a shallow pit, occupied by the muscle which keeps the valves closed. The common fossil known as *Ambonychia radiata* (fig. 110) may be cited, though doubtfully, for its true affinities are still obscure, as an example of this division. It is exceedingly abundant in the Hudson River Group of the Lower Silurian series.

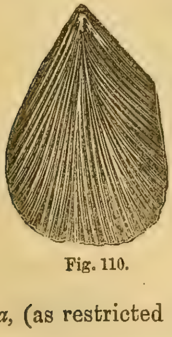

Fig. 110.

The forms of the second group, or *Orthoconcha*, (as restricted above*,) are also without siphonal tubes, but their valves are *right* and *left*, instead of *upper* and *under*, as regards the normal position of the animal, and the muscular impressions are two in each valve. The fossil species known as *Modiolopsis modiolaris* fig. 111, so common in our Hudson River Group, belongs in all probability to this division. The genus *Cyrtodonta* of Billings, (with its sub-genus *Vanuxemia*), may also be referred to the *Orthoconcha* of this Section. Fig. 112 represents the *Cyrtodonta Huronensis* (var. *subcarinata*) of the lower part of the Trenton Group. Another and more remarkable species of this genus—widely known as the *Megalomus Canadensis*, of Hall—occurs in great numbers in the Onondaga Salt Group, (Upper Silurian), of Canada West, and more especially in the neighbourhood of Galt. It is found chiefly in the form of internal casts, as shewn in the figures 113 and 113 *a*.

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* The term *Orthoconcha*, it should be observed, is applied by some palæontologists to our groups, 1 *b*, 2 *a*, and 2 *b*, collectively—the forms of the two first of these being united under the subordinate group of *Integro-Pallialia*.

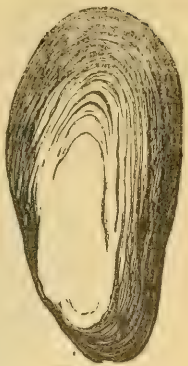
Fig. 111.

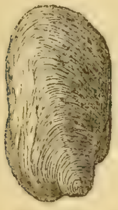
Fig. 112.

The *lamellibranchs* of the third group, *Integro-Pallialia*, have the upright (or right and left) position of the *orthoconcha* of Section I., but, unlike these latter, they possess a pair of short respiratory tubes. The muscular impressions, two in each valve, are connected, as in the forms of the last group, by one uninterrupted shallow groove or "pallial impression,"—*i.e.*, a continuous line without any bend or sinus in it. The existing fresh-water genus *Cyclas*, species of which occur in our

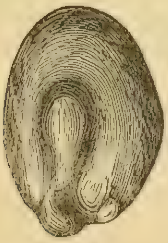
Fig. 113.

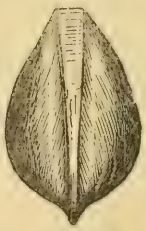
Fig. 113. *a*.

Post-Tertiary deposits, and especially in those of Western Canada, may be cited as an example of the present group. (See PART V.)

Finally, the *mollusks* of the fourth group, *Sinu-Pallialia*, possess a pair of long siphonal-tubes, capable of extension beyond the shell; and their two muscular impressions are united by a more or less deeply sinuated pallial line. Many of these lamellibranchs burrow in the sand of the shores on which they live, between the tide-marks, with their respiratory tubes extending to the surface; and fossil examples occupying this upright position, and thus shewing the animals to have been fossilized in their original burrows, are met with in certain strata. As examples of the group, we may refer to *Mya truncata*, fig. 114, and to *Saxicava rugosa*, fig. 115, both of which are of exceedingly common occurrence in the Post-Tertiary deposits of Eastern Canada.

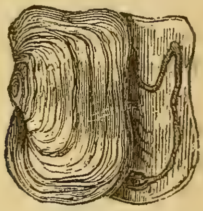

Fig. 114.

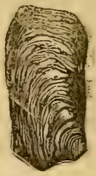

Fig. 115.

*Pteropoda*:—The living pteropods are swimming or floating mollusks, frequenting the open sea. Some few are naked, but the greater number secrete a delicate external shell (univalve,) and all possess a pair of fins or wing-like appendages for natatory purposes. In the pteropods with shells, the head is more or less indistinct. The *Conularia* is the only form of Canadian occurence, referrible, and that doubtfully, to this class. Fig. 116 represents *C. Trentonensis* of the Trenton Group. The shell in this genus is more or less conical and four-angled, furrowed longitudinally, and marked transversely by numerous straight or zig-zag lines. These latter often resemble rows of minute punctures. The genus extends from the Lower Silurian division into the Lias formation of the Mesozoic rocks.

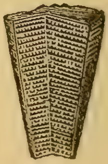

Fig. 116.

HETEROPODA.—The representatives of this class are regarded by many naturalists as forming simply an Order (*Nucleobranchiata*) of the class Gasteropoda. They constitute however a truly aberrant group, having affinities with the Pteropods on the one hand, and with both Gasteropods and Cephalopods on the other. Existing forms, like the pteropods, are of pelagic habit, swimming, by means of a fin-like appendage, in the open seas. The swimming organ is a modification of the gasteropod foot: see below. Some are without a shell, whilst others secrete one of a fragile and delicate texture, sometimes provided, as in many gasteropods, with a lid or "operculum," by which the opening of the shell is closed when the animal withdraws itself within it. The fossil genera *Maclurea*, *Bellerophon*, and *Cyrtolites*, from certain characters which their shells appear to possess in common with those of the modern genus *Atalanta*, are usually referred to this class; but much uncertainty still prevails with regard to the true affinities of these fossil types. The comparative solidity of the shell is opposed to their alliance with the *Atalantidæ*. Mr. Salter of the English Geological Survey, suggests, however, that *Maclurea* may have been a Heteropod with heavy shell, inhabiting the sea-bottom. Fig. 117, represents *Maclurea Logani* of the lower part of the Trenton Group; *a* is an inside view of the curious operculum often found detached. Fig. 118 is an example of *Bellerophon expansus*, and fig. 119 of *Cyrtolites ornatus*, of the Trenton and Hudson River Groups (Lower Silurian series.) By some palæontologists, the genera *Bellerophon* and *Cyrtolites* are considered identical.

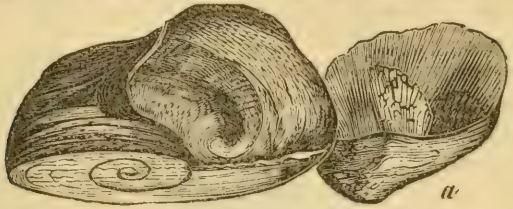

Fig. 117.

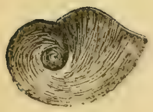

Fig. 118.

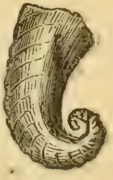

Fig. 119.

Gasteropoda.—The gasteropods have a distinct head; and all the typical species possess a fleshy expansion or foot on which they creep, and from which the class derives its name. The greater number secrete an external and univalve shell, but some few, as the common slug, are "naked" or possess merely a rudimentary shell; and in the *chitons* the shell is composed of several pieces. Some gasteropods, as the common snail, are terrestrial. Others, as the *limnea, paludina,* and *planorbis,* species of which are so common in our lakes and streams, inhabit fresh-water ; but the greater number inhabit the sea. The class may be subdivided naturally into two leading groups : *Branchifera* or water-breathers, and *Pulmonifera* or air-breathers.

The *Branchifera,* furnished with gills or branchiæ for breathing the air contained in water, include all the fluviatile and marine types. They fall into two sections : *Siphonostomata* and *Holostomata.* In the former, the opening or so-called "mouth" of the shell is more or less deeply notched at one or both extremities, or is otherwise lengthened into a kind of slit tube or "canal." The species are marine, and all are carnivorous. Comparatively few occur in the lower fossiliferous rocks, the place of the carnivorous gasteropods having been apparently supplied in great part, in the early geological epochs, by numerous predatory cephalopods. An example of this section is shewn in fig. 120, representing a species of *Buccinum* (closely allied to the existing *B. undatum,* if not identical with that species,) from the Post-Tertiary deposits of Eastern Canada.

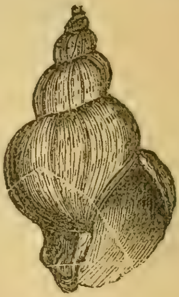
Fig. 120.

In the *Holostomata,* the aperture of the shell has an uninterrupted and more or less circular margin. The species are almost entirely vegetable-feeders. Representatives occur in all the fossiliferous rocks, and are numerous in existing Nature. The annexed figures

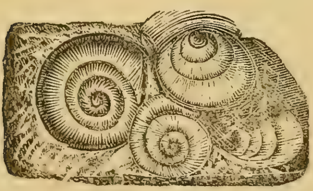
Fig. 121.

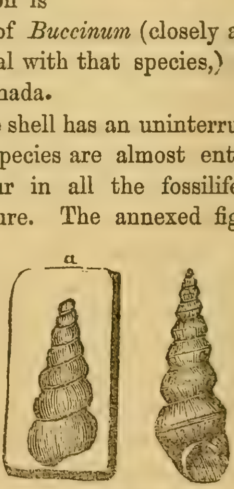

Fig. 122.

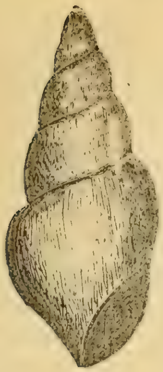

Fig. 123.

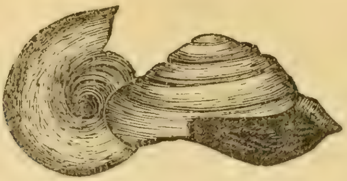

Fig. 124.

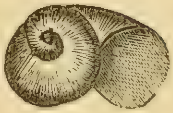

Fig. 125.

represent several of our more characteristic Canadian examples. Figure 121 is the *Ophileta* (formerly *Maclurea,*) *compacta* of the Calciferous-sand group (Lower Silurian.) Fig. 122 represents *Murchisonia gracilis, (a,* shewing internal cast); and fig. 123 exhibits a cast of *Murchisonia sub-fusiformis* of the Trenton and Hudson River Groups. *Pleurotomaria* (or *Trochonema*) *umbilicatula,* a common Trenton fossil, is shewn in fig. 124; and a cast of *Euomphalus rotundus* (?), a Devonian form, in figure 125.

The *Pulmonifera,* in place of branchiæ, possess a simple form of lung-structure by which they breathe air directly from the atmosphere. Some, as the snails, are terrestrial; others inhabit ponds, streams, and fresh-water lakes. All are vegetable-feeders; and the shell, in those forms which secrete one, is more or less light and thin. Our only fossilized examples, comprising existing species of *Helix, Limnea, Planorbis,* &c., occur in the higher Drift or Post-Tertiary deposits of Western Canada. These will be referred to, more particularly, in PART V.

The concluding part of this division of our subject, embracing the CEPHALOPODS, &c., will be given in a succeeding Number of the Journal.

# REVIEWS, TRANSLATIONS, AND SELECTED ARTICLES.

## NOTICES OF PAPERS IN FOREIGN JOURNALS.

1. *On the Existence of Dibranchiate Cephalopods of great bulk.*—The Cephalopods, the highest types of molluscous development, fall into two leading groups or orders. In the lower group, the animal possesses four branchiæ and numerous arms, and secretes an external many-chambered shell. The *nautilus* is the only remaining type of this group, so rich in representatives during the earlier and middle epochs of geological history. The forms of the second and higher group, have but two branchiæ, and but eight or ten arms ; but these latter are provided with suckers, or organs for obtaining a powerful hold of their prey ; and the animal is also furnished with a gland for the secretion of a dark fluid, which is ejected into the surrounding water when the creature is pursued or alarmed. These dibranchiate cephalopods inhabit a shell of a single chamber, as in the *argonaut*, or are otherwise " naked," as in all other types, including the sepia or cuttle-fish, the calamary, &c., genera unprovided with an external shell.

The known species belonging to the naked cephalopoda, vary in length, as a general rule, from two or three to eight or ten inches ; although a few species, in warm seas, attain to a length of two or even three feet. From time to time, however, strange accounts of gigantic cuttle-fishes have obtained, as in the case of the fabulous sea-serpent, a wide notoriety, and even a certain amount of credence, though finally regarded as altogether unworthy of belief. Many of these narrations, as that of the celebrated *Kraken* of Denis de Montfort, are evidently gross exaggerations, if not absolutely imaginary ; but, at the same time, the existence of dibranchiate cephalopods of large bulk, and of species as yet unknown to science, appears to be substantially true. The dead form discovered during the voyage of Quoy and Gaimard, and to which a weight of 224 ℔s., was attributed—the huge arms and other portions of a cephalopod found by Professor Steenstrup—and the large species, estimated to measure six feet in length, seen during the voyage of Banks and Solander—

may be mentioned in support of this view. Quite recently, a living cephalopod of still larger dimensions than those just cited, was encountered by the French frigate *Alecton*, between Madeira and Teneriffe. A description of this sea-monster is published by M. Bouyer, the lieutenant commanding the vessel, and another by the French consul at Teneriffe, in a recent number of the *Comptes Rendus*, (*No.* 27, *tome* liii). We translate from these a few of the more interesting passages.

The lieutenant of the vessel, M. Bouyer, writes from Teneriffe, under the date of December 2nd, 1861, to the Minister of Marine, le Maréchal Vaillant, as follows:—"I have the honor to inform your Excellency, that, after a favourable run, I cast anchor yesterday in these roads. A somewhat singular incident characterised our voyage. On the 30th of November at 2 o'clock in the afternoon, when about forty leagues N. E. of Teneriffe, we encountered a monstrous animal, which I recognised as the *Poulpe géant*, a creature generally regarded as belonging rather to fable than to reality. Finding myself in the presence of so remarkable a species—of one of those strange forms which the ocean sometimes casts up from its depths as though to tantalize and defy science—I resolved to examine it more closely, and, if possible, to secure it. Unfortunately a strong sea was running at the time, and this impeded the evolutions of the frigate; whilst the animal itself, although almost always at the surface of the water, moved two and fro with a sort of intelligence,* and seemed anxious to avoid the vessel. After several attacks, during which the creature was struck by about a dozen musket balls, we succeeded in getting sufficiently near to harpoon it, and contrived to work the line of the harpoon around its body. Whilst preparing to strike it anew, the creature by a sudden and violent effort freed itself from the harpoon; but the lower portion of its body, around which the cord was twisted, became torn away, and a large mass weighing over twenty kilogrammes (about 40 pounds) was drawn on board.

"We obtained a sufficient view of the animal to make a good sketch of it. It was evidently a gigantic calamary, but the form of the tail seemed to indicate an undescribed species. It appeared to measure from fifteen to eighteen feet from head to tail. The head, in shape like a parrot's beak, was surrounded, by eight arms of from five to six feet in length.* Its aspect is frightful; its colour, brick-red. In a word, this rudimentary creature, this viscous and colossal embryon, presents an aspect at once repulsive and terrible.†

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* M. Bouyer, it will be perceived, has a somewhat crude notion of the proper characters of the group to which the the animal seen by him belongs. In another part of his letter, he calls the cephalopod in question, "*un être ebauché*, a viscous and colossal embryon." When he wrote his description, he had evidently in his recollection that amusing book, as regards matters scientific, the "la mer" of M. Michélet.

M. Bouyer then goes on to state, that his officers and men wished to lower a boat and renew the attack, but that he feared to expose them to so unequal a contest, and that, finally, the chase was abandoned. The description drawn up by M. Berthelot, the French consul at Teneriffe, agrees essentially with that of M. Bouyer, although differing in some of its details. The animal is said to have presented a fusiform body, five or six metres in length, with a pair of fleshy lobes or fins at its lower extremity. It is also stated, that when wounded by one of the musket balls, the creature vomited a large quantity of blood mixed with slimy matters of a strong musky odour. A species of *Eledone* is known to emit an odour of this kind; but there are two points here of a somewhat suspicious character. In the first place, the blood of the cephalopods, as that of other mollusca, is colorless; and secondly, is it not remarkable that no mention is made of any discharge of "ink," during the attack to which the animal was subjected? The supposed appearance of blood, however, may have been caused by a discharge of this kind.

To the observations recorded by the actual observers of this creature, M. Milne Edwards has added the following remarks:—"The animal described in these communications, belongs apparently to one of those species of gigantic cephalopods, of which the existence has already been announced on various occasions, and the remains of which are preserved in several museums: in that, for example, of the College of Surgeons in London. Aristotle speaks of a large calamary (Τευθις), five cubits in length; and without referring to the fables of Pliny, and the evident exaggerations of Olaus Magnus and Denis de Montfort, we may recall the discovery of Péron, on the coast of Tasmania, of a calamary with arms of six or seven feet in length, and seven or eight inches in diameter. More recently

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* In the calamary the arms are *ten* in number. If the species really belong to the octopod division of the cephalopoda, it can scarcely be referred to any recognised genus. All the known octopods appear to possess a comparatively short and bursiform body, without "a tail" or expansion at the lower extremity.

† We here translate literally. It is perhaps needless to observe that the cephalopods are of comparatively high organization, or present, at least, nothing of an embryonic character. M. Michélet, we fear, has to answer for our author's zoology.

Messrs. Quoy and Gaimard found in the Atlantic Ocean, in the vicinity of the Equator, the remains of an enormous mollusk of the same family. They estimated the weight of the animal to which these belonged, to exceed 100 kilogrammes. Rang, also, saw in the same waters, a cephalopod of a red colour, and as large, according to his description, as a cask of the capacity of a tun. We are indebted likewise to Professor Steenstrup, of Copenhagen, for some very interesting observations on a gigantic cephalopod which was cast on the coast of Jutland in 1853. It is described by Professor Steenstrup under the name of *Architheuthis dux*. After the creature had been dismembered by the fishermen, and partly used for bait, its remains filled several barrows; and the pharynx, which had been preserved, is as large as a child's head. Finally, during the past year (1860) M. Harting described and figured various portions of an enormous animal of this family, preserved in the museum of Utrecht. We can scarcely imagine that these different observations refer to one and the same species. In all probability, therefore, several gigantic species of cephalopods, greatly surpassing in size all known Invertebrates, will be found to exist in the Atlantic and other oceans.

2. *On some Points connected with the Recent Eruption of Vesuvius*:—The same number of the *Comptes Rendus* contains some interesting communications on the late eruption of Vesuvius. During this eruption, an actual elevation of the district, to the height of several feet, is shewn to have taken place. The elevation appears to have gone on slowly during two or three days, and to have extended over a very considerable area. In a paper by Professor Guiscardi, the following statement is made with regard to this upheaval of the land:—"The next day [the 15th of December, 1861, the eruption having taken place on the 8th] I returned to Torre del Greco with Professors Palmieri and Napoli. M. Palmieri drew my attention to the inundated space around the public fountain. On the sea coast, carbonic acid was emitted through fissures in the lava of 1794, and also from the sea, causing in the latter a strong ebullition. M. Palmieri pointed out to me a long band of a whitish colour above the level of the water. We engaged a boat, and reaching the spot, found the height of this zone above the sea level to be 1·12 metre [=3 feet 8 inches]. It was covered with balani, patellæ, fissurellæ, oysters, &c., and with various bryozoons. There can be no doubt, consequently, as

to the upheaval of the shore. The raised band to which the balani, &c., were attached, was traced from Torre del Greco along the coast to Torre di Basano; but at the latter spot it had diminished in height to three decimetres [$=11\frac{5}{6}$ inches.] In connexion with this, we were assured that farther up the coast, as well as at Naples, the relative levels of land and sea remained unaltered. We crossed the place from which, with strong ebullition, the carbonic acid was constantly rising, and found the surface of the sea covered all around with a yellowish scum. At the bottom, there were many dead fishes and sepiæ." This phenomenon is fully confirmed by the observations of Messrs. Tchihatchef, Palmieri, and other geologists, as recorded in the same and other numbers of the *Comptes Rendus.* Professor Palmieri observes:—"The ground around Torre del Greco began to experience a movement of elevation at the first commencement of the eruption, and this movement continued during the two following days. The part of the town built on the compact lavas of 1794 suffered great damage; but the wells were not injuriously affected on this occasion. There was even an increase in the amount of water, accompanied by great ebullition, arising from the escape of carbonic acid. The emission of this gas from the sea bottom, destroyed a great number of fishes."

In a communication by M. Tchihatchef, the great similarity of the recent lavas to those of 1794 is pointed out. Both are remarkably free from leucite, but contain, in place of that mineral, a great abundance of pyroxene. M. Tchihatchef observes, however, that the one may be readily distinguished from the other, at least for a period of five or six years, by a simple botanical character: the older lava being covered by a thick growth of a lichen, *Stereocaulon Vesuvianum*, whilst the surface of the modern lava is quite bare. The lichen in question does not commence to grow on these rocks until after a lapse of several years.

Another fact of great interest, connected with this eruption, is the manifestation of combustible gases, consisting largely of carburetted hydrogen, and the simultaneous appearance of bituminous matters on the surface of the sea, at various points. An analysis of gas collected from the sea near Torre del Greco, yielded to Sainte-Claire Deville the following results; Carbonic acid, 59.53; combustible gas (nitrogen + carburetted hydrogen), 40.47. The same gas was observed to issue through crevices in the streets of Torre del Greco itself. M. Tchihatchef observes:—"I am the more inclined to believe that carburetted hydrogen is mixed at this locality with the emissions of carbonic acid, since the presence of the former gas will alone explain a phenomenon said to have been witnessed by the inhabitants, and confirmed by Professor Guiscardi, namely the apparition of small jets of flame darting through the crevices with which the streets of Torre del Greco are fissured. The exclusive presence of carbonic acid would, of course, render this phenomenon impossible."

May not the very constant association of bituminous matters with volcanic outbreaks, and their occurrence in many regions along lines of volcanic disturbance, lead us in some respect to modify our views with regard to the origin of petroleum and allied products? The almost universal opinion, at present, regards these compounds as essentially derived from the alteration of entombed vegetable or animal matters. That organic bodies may be converted in many instances into bituminous products of this character, no one will of course deny; but when we find, as in Western Canada for example, such immense quantities of petroleum in rocks far below the coal beds, and destitute in themselves of vegetable forms beyond a few fucoids—whilst the corals, brachiopods and other animal remains which they contain, are not more numerous than those enclosed in other rocks in which no traces of petroleum occur—does it not seem a less forced explanation, to look upon that substance as an original mineral formation produced far down in the earth's crust, just as lead, copper, and other metals must primarily have originated there, (account for their after distribution as we will), than to consider it in all cases as a secondary product derived from the alteration of vegetable or animal bodies? Modern theory, it is true, is inclined to refer all forms of carbon, even the graphite of meteoric stones, to organic origin—but theory in this case may be pushed a little too far. The non-existence of Benzole in our Canadian petroleums, as shewn by Professor Croft, is apparently in itself an argument against the supposed derivation of these bituminous matters from coal or other vegetable accumulations.*

3. *On Parthenogenesis as Occurring amongst Silkworms:*—A tradition has long prevailed around Lyons and throughout the south of

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* Although Canadian petroleum does not contain Benzole, it is quite available, according to Professor Hind of Trinity College, who has bestowed much attention on the subject, for the extraction of colouring materials of a similar character to those derived from coal oils.

France, as well as in Piedmont and Lombardy, that the most effectual means of restoring vigour to the silkworm stock, when this becomes deteriorated (as shewn by a poorer yield of silk, less numerous eggs, &c.), is to employ what is called "virgin seed," or, in other words, eggs laid by female moths that have been kept rigorously from contact with the males. Some researches made on this subject are published by M. Jourdan in the *Comptes Rendus* of December 16, 1861. Although placing no great faith in the statement in question, M. Jourdan determined to submit it to the test of experiment. Three hundred worms (of the *Briance* variety) were enclosed in separate boxes, each covered with a piece of guaze, of which the ends were closely sewed together. These worms yielded one hundred and forty-seven female, and one hundred and fifty-one male moths. The latter were removed, and the females were kept carefully imprisoned in their separate boxes. Out of the hundred and forty-seven moths thus preserved, only six yielded really fertile eggs. Two moths gave seven; two others, three; one, five; and one, two. These twenty-nine eggs, out of the whole number laid, and kept enclosed as above stated, were all that came to life. Some others, it is true, passed from the clear yellow into the greyish stage, after the manner of fertile eggs, but these finally proved abortive. The total number of eggs laid in this experiment, amounted to about 50,000: so that about one egg only in two thousand proved fertile.

In a second experiment, conducted in the same manner, but on another breed of silkworms (a Chinese variety), results of a much more striking character were obtained. Fifty cocoons were enclosed in separate boxes, as before. From these, twenty-three females and twenty-six males resulted. Of the former, seventeen produced fertile eggs. The most productive gave one hundred and thirteen, and the least productive yielded twelve. The proportion of fertile eggs to the total number laid, was about one in seventeen, or 530 in 9000.

The occurrence of *Parthenogenesis* amongst the Lepidoptera, appears, then, to be certainly verified; and this fact, as observed by M. Jourdan, cannot be looked upon otherwise than as one of great physiological interest, when we consider the advanced organization of the class in which it has been thus shewn to occur. An extension of these experiments, in order to test the duration of the peculiarity in question, is now desirable. The Chinese variety employed in M. Jourdan's second series of observations, passes through its various stages in the course of a few months; but the phenomenon of parthenogenesis will be found limited, in all probability, to a single generation. E. J. C.

# ON THE COMPARATIVE PROGRESS OF THE POPULATION OF ENGLAND AND SCOTLAND, AS SHEWN BY THE CENSUS OF 1861.

BY JOHN STRANG, LL.D.,
CITY CHAMBERLAIN OF GLASGOW.

(*From the Journal of the Statistical Society: December* 1861.)

If some distant and untutored foreigner happened to cast his eye over the map of the world, and were told by some enlightened bystander that within the comparatively small islands of Great Britain and Ireland there resided the elements of a first-rate political power, he would no doubt feel some little surprise at the intelligence; particularly were he, at the same time, informed that within the boundaries of Great Britain itself there was only a surface area of about 57 millions of statute acres. But the foreigner's surprise would be perhaps still greater were he further told that, while the southern portion of the island, called England and Wales—with a surface of little more than 37 millions of acres—had a population (as ascertained by the late Census, exclusive of the army and navy, and merchant service abroad) of 20,061,725; the northern portion, called Scotland—with a territorial surface of upwards of 20 millions of acres—contained only 3,061,329 inhabitants. Such, however, are the real facts of the case; and those like ourselves, who are acquainted with the distinctive physical peculiarities of the two portions of Great Britian, will feel little wonder about it.

There is, however, a subject connected with this territorial division of England and Scotland, and their distinctive populations, which is not so easily understood—we mean the fact, as shown by the Census returns of the present century, that there has existed for some considerable time, and particularly of late years, a marked difference in the ratio of the progress of the population within the limits assigned to the southern and northern portions of Great Britain respectively.

The following table will best exhibit this difference, by showing the annual progress of the population in England and Scotland since 1801, when the enumeration figures of both countries may be first truly relied on: —

| Year. | England and Wales. | Scotland. |
|---|---|---|
| 1801 ........ | 9,156,171 | 1,608,420 |
| '11 ........ | 10,454,529 | 1,805,864 |
| '21 ........ | 12,172,664 | 2,091,521 |
| '31 ........ | 14,051,986 | 2,364,386 |
| 1841 ........ | 16,035,198 | 2,620,184 |
| '51 ........ | 17,927,609 | 2,888,742 |
| '61 ........ | 20,061,725 | 3,061,329 |

From the foregoing table it appears that the population of *England and Wales* has, in the course of sixty years, increased to the extent of 10,905,554, whereas that of *Scotland* has advanced to the extent of only 1,452,909; exhibiting an increase on the part of England and Wales of 119·1 per cent., and on that of Scotland of only 90·3 per cent.; and if we merely compare the progress of the populations of the two divisions of the island respectively during the last ten years, we find that while England and Wales show an increase of 12 per cent., Scotland only exhibits an advance of 5·9, or about 6 per cent.

The question then naturally arises, how can this great and important discrepancy between the rates of progress in England and Scotland, particualarly as existing between the years 1851 and 1861, be explained? Has it been occasioned by a different birth and death-rate ruling in the respective portions of the island? or is it to be found in a larger proportional rate of emigration on the part of the North to that of the South? And if the latter be the case, what may be the probable causes which have led to that higher emigrating spirit?

Let us, then, attempt to discover what has been the actual *natural increase* of the population in *Scotland,* as deduced from the excess of births over deaths, since 1851. And here a difficulty meets us on the threshold—the fact that before the 1st January, 1855, there was no public register of births, deaths, and marriages kept in Scotland—and it is therefore only from the latter period that we can obtain any authentic figures wherewith to deal. Let us, however, see what these exact figures tell us, which will be best done in the following table:—

*Annual Table of Births and Deaths in Scotland from 1st January, 1855, till 30th June, 1861.*

| Year. | Births. | Deaths. |
|---|---|---|
| 1855 ........ | 93,349 | 62,004 |
| '56 ........ | 101,821 | 58,529 |
| '57 ........ | 103,628 | 61,925 |
| '58 ........ | 104,195 | 63,532 |
| '59 ........ | 106,732 | 61,754 |
| '60 ........ | 105,704 | 68,055 |
| '61(half year) | 54,625 | 33,863 |
|  | 670,054 | 409,662 |

From the foregoing table we at once discover that during the last six years and a-half the actual increase of the population from the excess of births over deaths amounted to 260,392; and, assuming that the average annual birth and death-rates then existing differed but little from those existing during the three and a-half years that preceded the passing of the Registration Act for Scotland—which rates were, say, birth-rate 3·41 per cent., death-rate 2·08 per cent.,—then it would follow that during that period of three and a-half years preceding 1st January, 1855, the births must have amounted to 346,115, and the deaths to 211,120, showing an excess of births over deaths of 134,995, and which, when added to the excess of births over deaths during the last six and a-half years, makes a *total natural increase* of the population in *ten years*, within the boundaries of Scotland, of 395,387, or at the rate of about 13·6 per cent. It is therefore quite evident, that had Scotland not been subject to the effects of a *serious emigration*, her population at last Census would have amounted to 3,284,129, instead of 3,061,251.

If such, therefore, may be taken as a proximate picture of the real natural progress of the population of Scotland, it necessarily follows, considering the immigration from Ireland into the West of Scotland, that the tide of emigrating Scotch to other countries must have been very great, especially during the last ten years; seeing that in addition to all the Irish immigration—which, however, has not been so large for these four or five past years—there must have gone out from Scotland no fewer than 222,878 persons, being the difference between the natural increase from the excess of births over deaths, and the increase as shown by the late Census.

According to the returns made to the Registrar-General by the Government Emigration Board, we find that during the last ten years, the estimated number of Scotch who have *emigrated* with the knowledge of the said Board has amounted to 183,627, leaving 39,251 which must have left otherwise, either to recruit the army and navy abroad, to push their fortune in various parts of the globe, unaccounted for by the Emigration Commissioners, or, what is more likely have gone to swell the population of England. That the population of England has been greatly increased from immigration will at once appear evident, when it is stated that while in the ten past years the *English-born emigrants* have amounted to 640,210, the *natural increase* of her population only exhibits 136,460 more than her ascertained population by the Census, showing an unaccounted for deficiency of 503,740, for which she must have been mainly indebted to Scotland and Ireland. That an emigrating spirit has manifested itself on the part of the Scotch more than the English is certain, from the fact that, taking the mean population for the last ten years of each country, we shall find that, had Scotland only emigrated proportionally to England, the Scotch emigrants ought only to have amounted to about 100,000, whereas the numbers stated by the Commissioners are 183,627.

If the emigration from Scotland has thus been so disproportionately great, it may be asked from what particular quarter of the country has this spirit chiefly manifested itself, or, in other words, in what division of the country has the population absolutely shown a decline? The following table will at once answer the question:—

*Table showing the Counties in Scotland where the Population was found* TO BE LESS *in* 1861 *than* 1851.

| Counties. | Numerically less by | Counties. | Numerically less by |
|---|---|---|---|
| Sutherland | 585 | Argyll | 8,303 |
| Ross and Cromarty | 1,427 | Bute | 420 |
| Inverness | 9,065 | Dumfries | 2,246 |
| Kincardine | 137 | Kirkcudbright | 691 |
| Perth | 5,149 | Wigton | 1,351 |
| Kinross | 949 | | |
| Clackmannan | 1,502 | | 31,825 |

It appears, then, from the foregoing table, that in twelve out of the thirty-three counties of Scotland there has been, since the Census of 1851, irrespective altogether of the natural progress of the population by excess of births over deaths, a *diminution* of the inhabitants to the extent of 31,825 ; and as these counties are almost entirely agricultural and pastoral, the fact would seem to indicate that either manual labour was less wanted in these particular districts, or that a better remuneration for labour and industry was offered elsewhere.

For a striking contrast to this state of things in the agricultural and pastoral parts of Scotland, we have only to look to the Census figures of the commercial, mining, and manufacturing county of Lanark, where we find, in the course of the last ten years, an *increase* to the population of no less than 101,290 ! The fact is, the increase of the population is almost entirely limited in Scotland to *towns*, and to these of the largest kind—the increase in towns being 10·9 per cent., whereas the rural districts only show an advance of 0·9, or not 1 per cent. ; or, if Scotland be divided into three great divisions—viz., called *Insular, Mainland-Rural, and Towns*—the insular will show a decrease of 3·6 per cent., the mainland-rural an increase of 3·9 per cent., and the towns an increase of 12·9. But, to show still more forcibly the decline that has taken place among those residing in the *rural* portions of Scotland, it may be mentioned that the small increase stated as occuring in the mainland-rural district of 3.9 per cent., is owing almost entirely to the increased population of the smaller towns situated within the limits of that great division of the country. The leading deduction, then, to be drawn from these dry statistical details is simply this, that there has existed for some time a manifest tendency on the part of the inhabitants of the country districts, and particularly of those dwelling amid the Highlands and Islands, to quit a land where rural labour was little wanted, and pastoral care was poorly paid, for other countries where both were in good demand and highly compensated ; or for towns and cities, where the hardy and unskilled labourer is almost always sure to find employment. That this emigrating spirit in search of future prosperity has proved as yet as advantageous to Scotland as it has certainly been to Ireland, will scarcely be denied, seeing that it increases not only the value of the labour, and raises the condition of those who remain behind, but elevates the position and increases the comforts of those who go away. And although there must ever be felt a pang on the part of a pilgrim family when abandoning for ever the cherished scenes of childhood, even when those are associated with nothing better than the comfortless home of the Highland cottar, still the mutual personal benefit that results from this separation has been generally found to be, to those gone and to those left, well worthy of the temporary pang.

Among the immediate causes which have led to the late depopulation of the Highlands and Islands, and the partial diminution of the inhabitants of the other rural districts of Scotland, we shall only allude first, to the great enlargement which has lately taken place in the sheep-walks and agricultural farms—particularly in the northern parts of the country—thereby diminishing a host of small master graziers, and even smaller agricultural tenants, each and all of them without energy and without capital; secondly, to the discouragement given to the continuance of unnecessary cottars and crofters idly occupying the country; and, thirdly to the effects and results of the late Highland famines, which have, alas, too sadly taught the poor and perishing denizens of a country that cannot maintain them, to flee for refuge to one more kind and hospitable.

If, however, from the returns of the present Census we have been told that the rural portions of Scotland have, with respect to population remained either stationary or have shown a tendency to decline, it is, at the same time, certain that in the great centre of trade, mining and manufactures—we mean in *Glasgow*—there has been a most marvellous increase in the amount of its inhabitants. For while at the commencement of the present century that city and its suburbs only contained 83,769 persons, the last Census revealed the fact that its population, with that of its increasing suburbs, amounted to 446,395, and which, when compared with the population residing on the same territory in 1851, showed an increase of no less than 86,357 during the last ten years, or a rate of 23·95, or nearly 24 per cent. That this increase has mainly arisen from a *constant immigration* from all parts of Scotland, and also from Ireland, is no doubt certain; for if we assume that the last year's birth and death-rates—which were, births, 3·87 per cent.; deaths, 3 per cent.—have been the average rates for the last ten years, which we believe is not far from the truth, and that the mean population during the same period may be fairly assumed to have been 403,000, it will then follow that the natural increase, arising from the excess of births over deaths, could not have amounted to more than above 35,000, which, being deducted from the ascertained increase as shown by the late Census, proves that the increase of the city and suburbs must have been supplemented by an immigration of upwards of 50,000.

That Glasgow, indeed, has been chiefly indebted during the last half century to the immigration which an increase of capital and an active and multifarious industry have induced, cannot better be illustrated than from the facts which our lately-printed analysis of the Enumeration Returns of the Glasgow Census then exhibited. From these the fact may be gathered that, independent of the many thousand individuals that have been attracted to that centre of Scottish industry from all quarters of Scotland, there were found within the limits of its municipality alone, on the 9th of April last, no less than 10,809 native English, 63,547 native Irish, 827 foreigners, and 1,440 colonists, being about 20 per cent., of the whole of that population.

In conclusion, let us merely add, although it is quite true that the population of Scotland has only increased, according to the late Census, about 6 per cent., and consequently only in a ratio of half the amount of that of England, it is, at the same time, certain that this diminution of ratio has not arisen from any falling off in the natural increase of the people, that is to say, in a diminution of the excess of births over deaths, but wholly and entirely from a most extraordinary amount of emigration by persons belonging chiefly to the insular and rural portions of the kingdom—an emigration which, in the peculiar districts affected by it, has been thereby benefited, and has not in the least degree interfered, but rather accelerated the progress of those leading marts of commerce and industry in Scotland, which have hitherto so successfully kept pace with their worthy commercial and manufacturing competitors in England. In a word, while Scotland, from its improved, and still improving, system of agricultural and cattle rearing, may feel well content to part with her supernumerary and unemployed peasantry, either to add to the prosperity of her urban seats of industry, or to continue to fulfil the old adage that in every nook of the world where any good is to be got, there is to be found a Scot, a rat, and a Newcastle grindstone—she at the same time cannot but feel assured so long as her soil is daily becoming more productive, and her manufactures, mining, and commerce are advancing, and her cities, harbours, and railroads are extending as they are at present found to be, that she is still on the pathway of prosperity, even although the Census has truly proclaimed that the progress of her population has only exhibited an increase of scarcely 6 per cent., during the last ten years of her history.

## BRITISH WEST INDIA COLONIES IN 1859.

### *Abstract of the Official Reports by the Governors.*

*(From the "Standard" Newspaper: Oct.* 1861.)

"Jamaica.—In 1859 (which is the last year of the official returns throughout the whole report,) the total revenue of this island was £279,935, and the expenditure £262,142. If we take the three preceding years we observe some fluctuations, which are trifling, and accounted for by purely local circumstances—as buildings and roads, and repayments of floating loans; but these we omit to specify, considering it more acceptable to our readers to devote our space to information rather of an Imperial than of a strictly local character. There is an island debt of £852,000, but it is in process of annual liquidation. There is no return of the population, but a census is ordered to be taken in 1861; but it is inferred from an ecclesiastical enumeration that the number of souls may be about 360,000. Taking an average of the years 1857, 1858, and 1859, the value of the four great staples—sugar, rum, coffee, and pimento, with logwood and dyewoods—was £1,056,890; and of the minor articles, £46,609. It is the strongly expressed opinion of Governor Darling, that, on an average of seasons, the *export of sugar* will rarely exceed 30,000 tons, unless immigrant contract labour be more largely employed; and this leads to the subject of negro industry. The Governor sees no prospect 'of an augmentation of the effective strength of that portion of the native population who work *for hire* on the larger plantations,' because he doubts whether sufficient wages can be given for sugar cultivation to stimulate the negro, who is fonder of his ease than of money. His wants are few, and he is indifferent to hoarding. The available statistics of agriculture are however scanty, and quite insufficient to convey a correct and comprehensive view of industrial occupations. But one remarkable fact appears well worthy of attention. If the African race cannot be roused to activity by high wages, they work diligently when they cultivate the *soil on their own account*; and these are now rising up as an independent, respectable, and trustworthy middle class. They are even becoming the employers of hired labour. The gratifying result is that the emancipated race evince a capacity for freedom when they can appropriate to themselves a fair share of the wealth they create. They properly value the possession of a leasehold or freehold property, and in due time we may hope to see labourers, animated by the example of their brethren who have achieved independence, more and more inclined to work for wages as the sole means, if accompanied by economy, of acquiring that capital which will place them in the position of becoming the owners of moderate holdings. Many years have elapsed since Mr. Carey, the American economist, expressed his conviction that what is now witnessed in Jamaica would prove the true solution of slavery in the Southern states. He predicts that a time will come when 'there will be seen to arise a class of free black men, cultivating for their own use their own land, bought from their old masters, who will find in the price of the land a compensation for the price of the labour.'*

"BRITISH HONDURAS.—Here the chief trade is *mahogany*, which has been entirely engrossed by four or five influential firms. Two of these failed in 1859, and the result was great distress at Belize. The resident importing merchants who used to sell goods to purchasers from the contiguous states of Central America have lost their customers by a change in the course of trade, because the facilities of steam packet navigation have induced foreigners to draw their supplies direct from British manufacturers instead of procuring them, as heretofore, through Belize. However, the staple trade in mahogany and dyewoods is maintained with vigour; and there is the prospect of easier communication with Guatemala. The trade of Honduras is, however, small. In 1859 the value of the exports was £288,000, and of the imports £175,000.

"BAHAMAS.—In 1859 the revenue was £30,727, net. This is a ridiculously small sum: but the value of the imports was £213,166, and of the exports £141,896. The staple produce of this colony consists of *pineapples and oranges;* but there is another source of trade which will astonish most of our readers—that is '*wrecks,*' which in the very words of the report are described as 'the great and constant element of our trade and revenue.' Neither agriculture nor manufactures offer any profit compared to that derived from the wrecker's vocation. But this subject is so curiously infamous that we shall transfer to our columns the language of the report :—'This calling, which distributes prizes among blacks and whites alike, puts on a level and gives to both the opportunities of easy self-indulgence. As I often had to remark, it involves crime and the connivance at crime. But I doubt whether the treacherous plots which are so successfully laid for the destruction of vessels are generally known to any but the commanders of the wrecking vessels and the masters of the wrecked ships. The crews, I imagine, have a general rather than a special knowledge of the schemes which bring the merchant vessel and the parasitic wrecker close together near a reef. The general demoralization which the system engenders throughout every class in the colony will increase until American shipowners set the example of greater honesty, and American underwriters are more anxious to suppress the crimes which they condemn than to make their remonstrances against the English Government the vehicle of puffing their own resources and touting for fresh customers.' The negro in the Bahamas is not so favourably spoken of as the negro in Jamaica. The negro creole in the Bahamas is not devoid of ambition. but lacks persistent will and energy, both physical and mental. He is happier with his hominy and plot of ground than he would be if assured of a handsome independence on the condition of eight or ten years' hard work. He is a grumbler and a gossip. Such are the descendants of the ancient slaves; but the case is very different with those fresh from Africa and just rescued from Spanish slave ships. These are generally useful and energetic, and they perform the rougher work of the colony. The mulatto and his varied species are the best of this race; they have pride, ambition, and energy, and, when educated, are capable of the success to which they aspire. Such are the distinctions pointed out by Governor Bayley. There is little industry in the Bahamas group. The islands of Eleuthera and St. Salvador raise fruit for the English and American markets, but in the whole colony the culture of corn is trifling, and that of cotton is wholly neglected, while the Nassau market is supplied with meat from the southern districts of the United States. It is recommended that steam navigation be established between New Providence and the out islands.

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* "The Past, the Present, and the Future," p. 364. By H. G. Carey.

"Turk's Islands.—These are an appendage to the government of Jamaica. The chief source of revenue is derived from the salinas, an export duty on salt being levied of one farthing per bushel of 35 imperial quarts. The population is only 3,250 souls, and with that fact we may dismiss this little group.

"Trinidad.—Taking an average of three years, the customs and tonnage duties figure for about £74,000, and the local revenues, which are the receipts of the ward unions, average £25,000. Lord Harris divided the island into wards, for which he is highly praised. The expenditure on the fixed establishments of the island is put down at about £53,000 ; but the unfixed and contingent charges are very large in proportion, those for 1859, exceeding £120,000. The value of the imports in 1859, was £730,000, and of the exports, £820,000. As cotton now occupies the manufacturing mind, we may state that in the year 1859, Trinidad exported 295 bales. The financial balance sheet last forwarded shows the estimated revenue of the island at £176,000, and the expenditure at £180,000, but this excess is increased by some local items which we need not enumerate; it is sufficient to state that the Governor proposes to make good the deficiency by an income tax of 5d., in the pound on all incomes of £100 and upwards, and he expects it will yield £8000 a year. Thus this bad fiscal principle, which all parties agree cannot be made practically equitable, is about to travel to the West Indies. The most interesting part of this report refers to *immigration*. It is known that most of the colonies must have perished, or returned to a state of weeds and jungle, had not labourers been procured from India and China after the Negro Emancipation Act had been passed. In 1858 the Indian population in Trinidad was 8,854; in 1859, it was 13,544, but this was not entirely due to fresh arrivals, but was partly attributable to the registration of many adults omitted in the former census, and principally to a more particular registration of children. In 1859 there were in the island 3,868 immigrants whose term of industrial residence had expired, and who are at liberty to work or not: but of these 1,360 renewed contracts with their employers, at a premium of from £2 to £4 per annum. This is a satisfactory proof that they have been well treated, and are content with their bargain. Of the 3,868 who have thus terminated their industrial residence, all are entitled to return passages, except 750 who arrived since January, 1854, who are consequently under a contract of residence for ten years, of which one-half must be passed under written agreement and one-half not. This leaves 3,118 entitled *at present* to return passages. Of these 210 registered themselves as wishful to proceed to India, but before the period of their departure arrived the great majority changed their minds and entered into fresh contracts, so that out of the total number only 35 resolved to quit, and most of these had acquired comparative affluence in trade. These are highly gratifying facts, and silence the libel of those who have compared the immigration system to slavery in disguise. The Bengalee coolies are preferred to those from Madras on account of their superior docility ; and the latter are said to be intemperate, idle, and desponding. In Trinidad there are orphan homes and training schools for Indian immigrants, and there is a well-balanced proportion between the children of both sexes, which augurs favourably for their social future.

" BRITISH GUIANA.—The revenue for the year 1859 was £275,-618, and the expenditure £263,194. The import duties are said to show an improvement of £24,000, but the total amount is not stated. The debt of the colony was £449,802, of which £320,000 was due to Her Majesty's Government. The military defences of the port, abandoned for want of means in 1854, have been resumed. The batteries are nearly complete, and are deemed effective against privateers. This is all of general interest that can be gathered from the report of Governor Wodehouse, which is very scanty ; nor is there a single appendix.

" BARBADOS.—The revenue for the year 1859 was £87,000 ; the expenditure £80,000 ; but on the four years ending with 1859 there was a surplus to the treasury of £32,000. During the last four years the debt of the colony has been extinguished, for though there remains an outstanding claim of £290, it cannot be called in. The imports for the year 1859 were £1,049,000 ; the exports £1,225,000. Barbados supplies *foreign manure* to the neighbouring British colonies and partially to the French. This inter-colonial trade in guano averages in value about £45,000 per annum. Governor Hincks, formerly Prime Minister of Canada, describes the condition of the island as prosperous.

"GRENADA.—The fixed revenue for the year 1859 was £13,500, raised to nearly £17,000, by additions accruing from taxes levied under a local money bill. Of this total about £9,500, are the proceeds of duties on imports. In consequence of the arrival of Indian labourers the duty on imported rice had risen from £297, to £517, and the abolition of tonnage duties is expected to give some stimulus to trade. The total value of imports was, in 1859, £124,000, and of exports £131,000. On both sides of this account some fractional deductions are made for goods imported and subsequently exported. Within the last three years agriculture has made considerable progress and it has been ascribed to the introduction of Indian labourers. By their industry seven large estates have been reclaimed in the last three years, these having been abandoned when the negro refused to work after his emancipation. They are now in a flourishing condition. The immigrants only number 879, but their presence and conduct are described as 'most telling on the Creole labourers.' So well contented are the labourers that they told Governor Hincks that they had no intention of returning home, but would settle in the island when their term of industrial residence had expired. This confirms the intelligence from Trinidad.

"TOBAGO.—Of this colony nothing is reported but what is strictly local. Everything is described as prosperous. In rouud numbers the population numbers 15,000.

"ST. VINCENT.—The information is very scanty. There is a great want of Indian immigrants. The island is highly fertile and well adapted to the sugar cane. It exports some hundred tons of pozzolani, which, mixed with two-thirds of lime, produce an excellent hydraulic mortar and cement for pavements. It is shipped at the rate of 8s. per ton. Here grow the bread-fruit trees most luxuriantly, as nutritious as the yam and potato. The cabbage trees are gigantic, and the palms are tall and stately. Some insect blight has killed the cocoa nuts. The bamboo cane is excellent.

"ST. LUCIA.—The population is put at 26,000, but this estimate is deemed below the actual amount. Some 1,200 Indian labourers have arrived, who do not appear to be enumerated, and many persons come to St. Lucia annually from other colonies, chiefly from Martinique. The coolies are reclaiming land thrown out of cultivation. Old buildings are repaired, and former activity and enterprise are being renewed.

"ANTIGUA.—The revenue for the year 1859 was £40,000; the expenditure, £39,000. There is a public debt due to Her Majesty's Treasury of £40,000. The last census of the population, taken in 1856, gave 35,408 souls. Five-sevenths of the population have ceased to reside on estates, but live in towns or villages. The average number of inmates to each dwelling in the towns and villages is nearly five and a-half; on the estates, scarcely three and a-half. Morality seems to have been almost exiled from Antigua. Out of 4,134 births registered in three years, 2,201 were illegitimate. This proof of vice, it is said, would be strengthened if the number of abortions and premature births could be ascertained. Here children are deemed an encumbrance to the mother; they are badly nursed, and badly fed, and are deprived of proper medical attendance. These are among the causes of declining population. Under slavery these evils did not occur; the planter provided the slave with everything needful. The imports of 1859 were £203,000; the exports £289,000. In the same year the exports of sugar were 13,706 hogsheads; of molasses, 675,000 gallons; of rum, 112,120 gallons. Formerly, in 1834, Antigua produced nearly 21,000 hogsheads of sugar; of late years it has rarely made 16,000. The soil is rich; the seasons very uncertain. Much land is still uncultivated. On the whole, the condition and prospects of the colony are considered by Governor Eyre as unsatisfsctory. What is chiefly wanted is a large influx of the industrious coolies.

"MONTSERRAT, ST. KITT'S, NEVIS, DOMINICA, THE VIRGIN ISLANDS.—These are all under the Governor of Antigua, and with it constitute the group known as the Leeward Islands, as Barbados, Grenada, Tobago, St. Vincent, and St. Lucia constitute the group known as the Windward Islands. Of the first four in the list of Leeward Islands no information of any European interest is conveyed in the report, and not much of the last, or Virgin Islands. Of these the most valuable product is copper, obtained from the mines of Virgin Gorda. The general exports go to the Danish islands of St. Thomas and St. Croix, which are only valued at £11,000; to British North American and West Indian colonies, £460; to the United Kingdom, *nil*. The exports referred to are horned cattle, horses, firewood, charcoal, and building lime; and if we notice such trifles it is because we wish to give a complete statement of what is scarcely known. The copper mine at Gorda was worked in 1839, and closed in 1842 for want of capital. In 1842 the copper raised from these mines, and sold at Swansea, yielded nearly 18 per cent. of marketable metal, and realised a price of £16. 1s. 6d. per ton. The works are resumed under favourable auspices, and the returns are said to be rich and abundant.

"MAURITIUS.—This Island is the most productive of the sugar colonies of the British Crown In 1859 the revenue amounted to £597,000 in respect of receipts within the colony alone, and was augmented by £12,000 received by agents in London for dividends and profits on investments. In the same year the expenditure was £553,000. The remittances to India on account of coolie immigration were £53,000. There are paper-currency notes in circulation which exceed £200,000 in amount. These are covered by cash in the Commercial and Oriental Banks, and by Consols which stand in the name of the commissioners of the currency. The savings' bank flourishes, and its utility is more appreciated as its operations are known. About one-third of the depositors are Indian coolies, who there hoard up the earnings which they take home when their term of industrial residence has expired. In 1858 these depositors drew £10,151, on their departure for India—a gratifying fact in a double sense, as it shows their wages to be liberal, and that they are a thrifty race. There can be no doubt of the readiness of the Hindoos to work the soil of Mauritius when they can realise such large emoluments, and it is clear that if the natives were proportionately remunerated in their own country the charge of laziness so unjustly preferred against them would disappear. Their employers will not invest capital unless they have the certainty of high profits; and why should it be expected that labourers will work for them unless they receive high wages? In 1859 the sugar crop exceeded 115,000 tons, chiefly sold in English, French, and Australian markets. The total value of goods imported was £2,025,890, and of specie £414,931. Total value of goods exported, £2,544,000; and of specie, £14,906. The declared value of sugar exported, the produce of the colony, was £2,346,427. The tonnage of vessels entered inwards was 304,616, outwards 308,642.

| | |
|---|---|
| The general population of the island is computed at......... | 96,526 |
| Immigrant Indian population.............................. | 201,979 |
| Alien population, chiefly Chinese......................... | 6,541 |
| | 305,046 |

The population in 1859 was one-third larger than in 1851, when the census was taken. At Seychelles and the other dependencies of Mauritius there are 8,001 souls. This great increase is due to arrival of the coolies, whose contract term of residence is five years; and, as already stated, the treatment they receive and the wages they earn, ensure a continuous supply of Indian labour."

# SCIENTIFIC AND LITERARY NOTES.

## GEOLOGY AND MINERALOGY.

### ON SOME ADDITIONAL REMAINS OF LAND ANIMALS IN THE COAL MEASURES OF NOVA SCOTIA.—BY J. W. DAWSON, LL.D., F.G.S., PRINCIPAL OF MCGILL COLLEGE, MONTREAL.

*(From the Journal of the Geological Society of London, February,* 1862.*)*

In the long range of rapidly wasting cliffs at the South Joggins, every successive year exposes new examples of erect trees and other fossils; and, as the removal of the fallen débris is equally rapid with the wasting of the cliff, it is only by repeated visits that the geologist can thoroughly appreciate the richness of this remarkable section, while every renewed exploration is certain to be rewarded by new facts and specimens. The present notice is intended to record the gleanings obtained in my last visit, in connexion with the presentation to the Society of a suite of specimens of the fossil Reptiles and other land-animals of the locality, which I desire to deposit in the Museum of the Society, that they may be more fully studied by comparative anatomists, and may remain as types of the species, accessible to British geologists.

In the bed which has hitherto alone afforded reptilian remains in the erect trees, two additional examples of these were exposed. One was on the beach, and in part removed by the sea. The other was in the cliff, but so far disengaged that a miner succeeded in bringing it down for me. In the first comparatively little was found. It afforded only a few shells of *Pupa vetusta*, and scattered bones of a full-grown individual of *Dendrerpeton Acadianum*

The second tree was more richly stored; and, being *in situ*, was very instructive as to the mode of occurrence of the remains. Like all the other trees in which reptilian bones have been found, it sprang immediately from the surface of the six-inch coal in Group XV. of my section,* which is also Coal No. 15 of Sir W. E. Logan's section.† Its diameter at the base was 2 feet, and its height 6 feet, above which, however, an appearance of additional height was given by the usual funnel-shaped sinking of the overlying beds toward the cavity of the trunk. The bark is well preserved in the state of bituminous coal, and presents externally a longitudinally wrinkled surface without ribs or leaf-scars; but within, on the "ligneous" surface, or that of the inner bark, there are broad flat ribs and transversely elongated scars. The appearances are precisely those which might be expected on an old trunk of my *Sigillaria Brownii*, to which species this tree may have very well belonged.*

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* Quart. Journ. Geol. Soc. vol. ix. p. 58, and vol. x. p. 20.

† Reports of Geol. Survey of Canada, 1845.

The contents of the trunk correspond with those of others previously found. At the bottom is the usual layer of mineral charcoal, consisting of the fallen wood and the bark of the tree itself. Above this, about 2 feet of its height are filled with a confused mass of vegetable fragments, consisting of *Cordaites*, *Lepidodendron*, *Ulodendron*, *Lepidostrobus*, *Calamites*, *Trigonocarpum*, stipes and fronds of Ferns, and mineral charcoal; the whole imbedded in a sandy paste blackened by coaly matter. In and at the top of this mass occur the animal remains. The remainder of the trunk is occupied with grey and buff sandstone, containing a few fragments of plants, but no remains of animals.

Portions of six reptilian skeletons were obtained from this trunk. The most important of these is a large and nearly complete skeleton of *Dendrerpeton Acadianum*—by far the most perfect example, as I suppose, of any carboniferous reptile hitherto found. I shall not attempt to describe this specimen, and the new points of structure which it illustrates; but I send the specimen itself, in the hope that its details may be examined and described by the eminent naturalist by whom the species was originally named and characterized. Another specimen found in this trunk is a jaw of an animal about the size of *Dendrerpeton Acadianum*, but with fewer and larger teeth. I send this specimen, which may possibly indicate a new species. The remaining skeletons were imperfect, and belonged to a small individual of *Dendrerpeton Acadianum*, two of *Hylonomus Lyelli*, and one of *Hylonomus Wymani*. The dislocated condition of these and other skeletons is probably due to the circumstance that, when they were introduced, the matter filling the trunk was a loose mass of fragments, into the crevices of which the bones dropped, on decay of the soft parts. Most of the skeletons lie at the sides of the trunk, as if the animals had before death crept close to the walls of their prison. At the time when the reptiles were introduced, the hollow trunk must have been a pit four feet in depth.

A number of specimens of *Pupa vetusta* and *Xylobius Sigillariæ* were found, but nothing throwing further light on these species.

I found in this trunk, for the first time, indications of the presence of *Insects*. The remains observed were disjointed and crushed fragments, and as they did not include wings or elytra, I cannot give any decided opinion as to the orders to which they may have belonged. The most proboble conjecture would be that they were *Neuroptera* or *Orthoptera* of large size. The most interesting fragment obtained is a compound eye, imbedded in coprolitic matter, along with obscure portions of limbs and abdominal segments. Its facets are perfectly preserved, and are lined with a brownish bituminous matter, simulating the original pigment. These remains are at least sufficient to prove that in Nova Scotia, as in Europe, Insects inhabited the coal-forests, and that they furnished

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* Quart. Journ. Geol. So. No. 68, p. 523.

a portion of the food of *Dendrerpeton* or its allies. I may mention here that in other coprolites quantities of segments of *Xylobius* occur, and that there are some little groups of bones of very small reptiles, which are probably coprolitic.

The beds on a level with the top of this erect tree are arenaceous sandstones, with numerous erect *Calamites*. I searched the surfaces of these beds in vain for bones or footprints of the Reptiles which must have traversed them, and which, but for the hollow erect trees, would apparently have left no trace of their existence. On a surface of similar character, 60 feet higher, and separated by three coals with their accompaniments, and a very thick compact sandstone, I observed a series of footprints which may be those of *Dendrerpeton* or *Hylonomus*. The impressions are too obscure to show the toes distinctly. They are half an inch in length, with a stride of about 2 inches. On neighbouring layers were pits resembling rain-marks, and trails or impressions of a kind which I have not before observed. They consist of rows of transverse depressions, about an inch in length and $\frac{1}{4}$ of an inch in breadth. Each trail consists of two of these rows running parallel to each other, and about 6 inches apart. Their direction curves abruptly, and they sometimes cross each other. From their position they were probably produced by a land or freshwater animal—possibly a large Crustacean or gigantic Annelide or Myriapod. In size and general appearance they slightly resemble the curious *Climactichnites* of Sir W. E. Logan, from the Potsdam Sandstone of Canada.

I have long looked in vain for remains of land-animals in any other situation than the erect trees of the bed above referred to; but on my last visit I was much gratified by finding shells of *Pupa vetusta* in a bed of 1217 feet below the former, in the upper part of No. 8 of my section, or about 15 feet below Coal No. 37 of Logan's section. The bed in question is a grey and greyish-blue under-clay, full of Stigmarian rootlets, though without any coal or erect trees at its surface. It is 7 feet thick, with sandstone above and below. The shells occur very abundantly in a thickness of about 2 inches. They have been imbedded entire; but most of them have been crushed and flattened by pressure. They occur in all stages of growth; but the most careful examination did not enable me to detect any new species. With them were a few fragments of bone, probably reptilian. This discovery establishes the existence of *Pupa vetusta* in this locality during the deposition of twenty-one coal-seams, and the growth and burial of at least twenty forests; and from the occurrence of numerous specimens at both extremes of this range, without any other species, it would seem as if, for this locality at least, this was the only representative of the shell-bearing Pulmonates.

I append a list of the specimens forwarded to the Museum of the Society, and which, with those formerly sent, constitute a complete collection of the air-breathing animals hitherto recognized in the Coal-measures of Nova Scotia.

*List of specimens of Reptiles, &c., from the Coal-formation of Nova Scotia, accompanying this paper.*

1. *Hylonomus Lyelli.* A nearly complete skeleton, and the maxillary bone and teeth of another specimen.

2. *H. aciedentatus.* Maxillary bone, vertebræ, ribs, scales, and foot.
3. *H. Wymani.* Lower jaw, vertebræ and other bones, and scales.
4. Jaw of a Reptile, supposed to be new.
5. Skin and dermal plates of *Hylonomus.*
6. *Dendrerpeton Acadianum*, Owen. A nearly complete skeleton.
7. *Pupa vetusta*[*]. From a bed 1217 feet below that in which the species was originally recognized.

### NEWLY FORMED VOLCANIC ISLAND IN THE CASPIAN SEA.

[Extract from a Report published in the "Russian Naval Review," translated by Lieut. LÜTKE, and communicated by Sir R. I. MURCHISON, V.P.G.S.]

On the 8th of August last, the steamer "Turkey," in going to Asterabad, stopped (in the middle of the Caspian) at a distance of several fathoms from a a newly formed island. We went to it in a boat and landed. The length of it is 23 fathoms, the breadth 12 fathoms, the height above the water 6 feet; the average depth of the sea at the distance of 5 to 6 fathoms off the island is also 6 feet. The ground is so loose yet, that the swell of the sea sweeps it away. It is very difficult to walk on the island, as the feet sink into the ground. The action of fire is to be observed all over the island. One may conclude that a short time ago it was yet in a liquid state; for the strong smell of petroleum indicates plainly a volcanic origin, and petroleum is to be seen on the stones mixed up with the earth, the whole having cooled and being now comparatively hard. In passing on the lee side of the island we also perceived the smell of petroleum.

It appears that this newly formed islet lies upon a continuation of the volcanic emanations which trend from the mud-eruptions near Kertch to the fires of Bakou, and in a line towards Asterabad.—*Journal of Geological Society*, 1, xviii.

### PRODUCE OF BRITISH MINES FOR THE YEAR 1860.

The following summary, from the Government returns, shews the amount of coal, iron, copper, lead, silver, and tin, obtained from the mines of Great Britain and Ireland during the above year.

*Coal.*—English collieries, 2,024—products, 50,297,115 tons; Welsh, 443—products, 11,262,850 tons; Scotch, 413—products, 10,300,000 tons; and Irish, 73—products, 120,300. Total, 2,949 collieries—71,979,765 tons. Estimated value at the pits, £17,226,526, or $86,132,630. Of these products, London took 5,073,276 tons, of which 3,573,377 were carried by sea in 11,226 vessels, and 1,499,899 tons by railroad, canal, &c.

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[*] I observe that Professor Owen proposes the name "*Dendropupa*" ("Palæontology," 1860, p. 79); but I have retained *Pupa* for the present, not being satisfied that there is any good generic distinction; though I admit that the form of the aperture suggests the possibility of affinity to *Bulimus* as well as to *Pupa.*

Mr. J. G. Jeffreys, F.G.S., who considers the shell to be a true *Pupa*, has kindly directed my attention to traces of ridges observable on the collumella of one specimen, and which he regarded as corresponding with the screw-like plates in the young of *Pupa umbilicata* and *P. ringens.* This appearance I have observed in specimens now in my possession; and at one time I supposed that I had made out a distinct tooth, but, not finding this in other and less compressed individuals, I concluded that it was an effect of pressure; in which, however, I may have been mistaken, as Mr. Jeffreys states that these processes have no connection with the teeth in adult specimens, and that even the toothless variety of *P. umbilicata* is furnished with them.

*Iron Ore.*—In England, 4,910,469 tons; in Wales, 736,830 tons; in the Isle of Man, 1,282 tons; in Scotland, 2,225,000 tons; and in Ireland, 3,000 tons—total, 6,796,581 tons, valued at £2,507,860, or $12,539,300.

*Pig Iron Made.*—In England, 1,740,084 tons; in Wales, 1,012,270 tons; and in Scotland, 960,550 tons—total, 3,712,904 tons, valued at £11,138,712, or $55,693,560.

*Copper Mines and Ore.*—In England, 151 mines, 211,504 tons of ore; in Wales, 9 mines, 10,673 tons; in Isle of Man, 1 mine, 354 tons; and in Ireland, 10 mines, 14,258 tons. Total, 171 mines—236,789 tons, valued at £1,500,535, or $7,534,175.

*Fine Copper from above Ores.*—In England, 13,946 tons: in Wales, 550 tons; in Isle of Man, 26 tons; and in Ireland, 1,246 tons. Total, 15,775 tons, valued at £1,734,700, or $8,763,500.

*Lead Mines and Ores.*—In England, 161 mines, 63,858 tons of ore; in Wales, 82 mines, 20,056 tons; in Isle of Man, 3 mines, 2,464 tons; in Scotland, 7 mines, 1,946 tons; and in Ireland, 11 mines, 2,457 tons. Total, 264 mines, 91,381 tons, valued at £1,256,641, or $6,283,205.

*Metallic Lead from above Ores,*—In England, 42,762 tons; in Wales, 15,620 tons; in Isle of Man, 1,880 tons; in Scotland, 1,347 tons; and in Ireland 1,624 tons. Total, 63,233 tons, valued at £1,405,925, or $7,029,625.

*Silver extracted from Lead Ores.*—In England, 402,176 ounces; in Wales, 84,101 ounces; in Isle of Man, 56,974 ounces; in Scotland, 4,022 ounces; in Ireland, 13,898 ounces; and in places not accounted for, 346 ounces. Total, 561,617 ounces, to which add silver from British silver ores, 16,660. Total silver produced in 1860, 578,277 ounces, valued at £159,026, or $795,130.

*Tin Mines, Ore and Metal.*—In Cornwall and Devonshire, 128 mines, 10,180 tons of ore, valued at £738,488, or $3,692,440. From this ore, 6,497 tons of metal were produced, valued at £850,452, or $4,252,260.

*Recapitulation.*

| | Mines. | Product. | Value. |
|---|---|---|---|
| Coal | 2,949 | 71,979,765 tons. | $86,132,630 |
| Iron ore | | 7,896,581 " | 12,539,300 |
| Pig iron | | 3,712,904 " | 55,693,560 |
| Copper ore | 171 | 236,789 " | 7,534,175 |
| Fine Copper | | 15,775 " | 8,673,500 |
| Lead ore | 264 | 91,381 " | 6,283,205 |
| Metallic Lead | | 63,233 " | 7,029,625 |
| Silver | | 578,277 oz. | 795,136 |
| Tin ore | 128 | 10,180 tons | 3,692,440 |
| White Tin | | 6,497 " | 4,252,260 |

### PRIMORDIAL SANDSTONE OF THE ROCKY MOUNTAINS.

Dr. F. V. Hayden has sent us a very interesting paper, reprinted from a late number of the *American Journal of Science and Art*, on the "Primordial Sandstone of the Rocky Mountains in the North-Western Territories of the United States." The wide occurrence, in that region, of sandstones and conglomerates resting immediately, but unconformably, on rocks of Azoic age, and containing fossil types of the Primordial or Potsdam sandstone zone, as recognized in New York, appears to be fully established. We quote from Dr. Hayden's concluding remarks the following analytical summary of the various points discussed in his communication:—

"1. We have the most undoubted evidence of the existence of that division of the Primordial Zone which is the equivalent of the Potsdam sandstone of the New York series, in two important ranges of mountains, outliers of the great Rocky Mountain chain. All the fossils are well known Primordial types, and at least two species are identical with forms occurring at the typical localities of this period in the Eastern States. The others are forms closely allied to species found in the equivalent rocks both in this country and in Europe.

"2. This division of the Primordial Zone, as a rule, appears as an underlying formation when the conditions are such as to expose it to view, from the Atlantic coast to the crest of the Rocky Mountains, and probably farther. Localities doubtless do occur where rocks of more recent age than the Potsdam sandstone rest directly upon the Azoic or granitic rocks below, but these facts do not militate against the general rule. Having proved its existence in two important ranges of mountains from its organic remains, by means of lithological resemblance and stratigraphical position, we have, with considerable confidence, traced it by personal observations throughout the mountainous district comprised within lat. 40° and 49°, and lon. 103° and 112°. From these facts, and the observations of reliable explorers in different parts of the West, we think we are warranted in the belief that this rock is exposed all along the margins of the Rocky Mountain range when not eroded away or concealed by overlying formations. How far westward of the dividing crest of the Rocky Mountains it extended we have no data for determining, nor can we hope to have where eruptive rocks seem to predominate. As yet we have not known the Potsdam sandstone to be exposed except along mountains with a true granite nucleus.

"3. Wherever this rock occurs, we are struck not only with the singularity of the organic remains, but also with the remarkable uniformity in the nature of the sediments and the general lithological appearance, compared with its equivalents in more eastern localities. We do not believe this to be due to currents of water bearing the materials from far eastern lands, but that the sediments were obtained from the vicinity, and that the uniformity in their character arises from the nature of underlying rocks from which they were derived.

"The Potsdam sandstone is everywhere composed of calcareous and silicious matter, granular quartz, ferruginous material in great quantities, also pebbles of various kinds, worn and unworn, with now and then seams and layers of argillaceous material. We find in the Azoic rocks below an abundance of limestone, clay slates, mica schists, seams of white quartz, granite composed largely of feldspar, and we can readily detect the source of the fragmentary masses which form the conglomerates. We also know that while nuclei of certain mountain ranges on the eastern slope are composed of a massive feldspathic granite, a great thickness of more recent or overlying rock, forming the lower and smaller ridges are composed of a kind of 'rotten granite,' which is so full of the hydrated oxyd of iron that it readily decomposes on exposure to the atmosphere. We therefore believe that the source of all the sediments composing the Primordial rocks in the West can be traced to the underlying rocks in the vicinity.

" 4. There are no indications of long continued deep water in the Primordial sea, so far as the West is concerned. If we examine the lower part of the Potsdam sandstone we find that the physical conditions which ushered in this period were quite violent, as shown by the conglomerate character of the rock. Passing upward, this conglomerate graduates into a rock composed of granules of quartz and small plates of mica cemented with calcareous matter, and about midway in the formation we have a fine, very ferruginous calcareous sandstone, in thin layers, filled with fossils in a very good state of preservation. The condition of the organic remains, the fineness of the sediment, and the perfect horizontality of the laminæ of deposition indicate a short period at least, of quiet water. As we continue upward the rocks begin to show the shifting nature of the currents, shallow water, and perhaps a proximity to land, by obliqne laminæ of deposit, ripple markings and fucoidal remains. The upper portion of this rock contains no fossils, nor were the physical conditions such as to have preserved them even if they had existed.

" 5. There seem to be evidences of a gradual thinning out of the Primordial sandstone in its far western extension, as also of all the Palæozoic formations. According to Dr. Owen, the Protozoic sandstones in Minnesota are at least 500 to 600 feet in thickness, and in Iowa, Professor Whitney estimates them at from 250 to 400 feet. In Tennessee, Prof. Safford finds several thousand feet of rocks, which he refers to this age, and in Texas, where they seem to be quite well exhibited and to yield a large number of fossils, Dr. Shumard gives them as only about 500 feet. In the Rocky Mountain district they are seldom more than 80 feet, and never over 200 feet. Indeed all the primary fossiliferous rocks are but thinly represented there, while the lower secondary formations begin gradually to increase in force until all along the eastern slope we have an enormous development of the upper Secondary and Tertiary, with an aggregate thickness of from 8,000 to 10,000 feet.

" 6. So far as we yet know, there is no unconformability in any of the fossiliferous sedimentary rocks of the northwest from the Potsdam sandstone to the summits of the true Lignite Tertiary. There are proofs of two great periods of disturbance which had a marked influence upon the physical geography of the West. The one occurred prior to the deposition of the Potsdam sandstone when the Azoic or granitic rocks were elevated into a more or less inclined position, and the other and most important period took place at the close of the accumulation of the great Lignite Tertiary deposits, when the great lines of fracture were produced, and the massive nuclei of the mountain ranges were raised above the surrounding country.

"7. What changes took place in the physical geography of the West during the long period which must have elapsed after the deposition of the Potsdam sandstone until the commencement of the Carboniferous age, we have very few data to determine. We are inclined to think that this portion of the West at least was elevated above the water level during the greater part of that period; the numerous indications of shallow water during the accumulation of the Potsdam sandstone, and the almost entire absence of rocks of intermediate age over so large an area, further strengthens that opinion. It is true, that in the far Northwest we have proofs that the hiatus is partially filled, but in the South and Southwest, the evidence is still more meagre. Near the Humboldt Mountains, in Utah, Messrs. Meek and Engelmann have detected proofs of Devonian rocks, but they are not known to be largely developed, and on the western declivity of the El Paso Mountains, Dr. G. Shumard found 'well marked strata of the inferior Silurian system corresponding in age to the Blue Limestone of Cincinnati and the Hudson River group of the New York series.' But so far as our present knowledge extends, rocks of intermediate ages do not form a prominent feature in the geology of the West."

## MINERALOGICAL NOTICES.

*Meteoric Stones.*—Rammelsberg (*Chemisches Central Blatt*, No. 1, 1862, quoted from the *Bericht der Akad. der Wissenschaften zu Berlin*) has examined some aerolites and supposed meteoric stones from North America. An analysis of the celebrated aerolite of Bishopsville, South Carolina, yielded the following results: Silica, 57.52; alumina, 2.72; sesqui oxide of iron, 1.25; oxide of manganese, 0.20; Magnesia, 34.80; lime, 0.66; soda, 1.14; potash, 0.70; ignition loss, 0.80 = 99.79. This composition is considered to indicate a mixture of several substances, rather than a single definite compound. The supposed meteoric origin of the so-called aerolites of Waterloo, Seneca County, New York, of Richland in South Carolina, and Rutherford, North Carolina, is shewn (as already surmised by others) to be entirely fallacious. The first is merely a ferruginous clay; the second, in all probability, a fragment of brick or tile; and the third, an impure cast iron, containing 15.7 per cent. of silica.

*Pholerite.*—M. Pisani (*Comptes Rendus* 24, LIII.) has published an analysis of the pholerite of Lodève, obtained by M. Sæmann. The analysis yielded: silica, 47.0; alumina, 39.4; water, 14.4. This gives, according to the author, $3\,Al^2O^3, 4\,SiO^3 + 6\,HO$; better transposed into: $Al^2O^3, 2\,SiO^2 + 2\,HO$. The latter formula agrees exactly with that of the pholerite of Freiberg analysed by Müller, and it corresponds also (although M. Pisani makes no allusion to this) with the formula of the Pensylvanian pholerite examined by Dr. Genth.

*Wagite.*—Under this name (in honor of M. Waga, a naturalist of Warsaw,) M. Radoszkovski describes, in the above number of the *Comptes Rendus*, a hydrated silicate of zinc from Nijni-Jagust, in the Oural. It occurs in concretionary masses, with an indistinctly crystallized surface, of a light greenish-blue colour. H. 5.0 ; sp. gr. 2.707; infusible. The analysis yielded : silica, 26.0 ; lime, 1.55 ; oxide of zinc, 66.9 ; water, 4.7—with traces of copper and iron oxides. This leads to the old formula $3\ ZnO, SiO^3 + HO$ [modernized into $3\ (2\ ZnO, SiO^2) + 2\ HO$] which only differs from the formula of electric calamine by a little less water. Unless the crystallization be shewn to be really distinct, this substance can scarcely be separated from the latter mineral.

*Dr. Genth's Contributions to Mineralogy.*—In continuation of his investigations, communicated, under the above title, to the *American Journal of Science and Art*, Dr. F. A. Genth has published a further and valuable series of observations on various American minerals. These comprise, more especially, *Pseudomorphous gold* after Aikinite (Needle ore), from Georgia (?) ; *Antimonial Arsenic* from California ; the Lake Superior arsenides of copper, *Whitneyite* (with which, it should be remembered, the so-called *Darwinite* of Forbes and Field is identical), *Algodonite*, and *Domeykite ; Pseudomorphous copper glance* after Galena (the so-called *Harrisite* of Shepard) ; *Millerite* from the Gap mine, Lancaster county, Pennsylvania ; *Automolite* from the Canton mine ; *Pyrope* from Santa Fé, New Mexico ; and other species. We regret that our limited space prevents us from referring more fully, at present, to these trustworthy and very able investigations.

E. J. C.

## PUBLICATIONS RECEIVED.

*Malcolm's Genealogical Tree of the Royal Family of Great Britain.*

This ingenious chart of the direct and collateral descendants of the founders of Britain's Royal line, forms a tasteful and very appropriate addition to our Canadian school-room apparatus. The foreground represents a specimen of as rough a clearing as any of the newest of Canadian settlements could offer to the artist's eye; but the various stumps on more careful inspection are seen to be the emblems of the Saxon Heptarchy, chopped down at the dates specified on each, and superseded, so far as Saxon England is concerned, by the one vigorous trunk of Egbert of Wessex. The roots of such trees being, we presume, presumed to lie fairly out of sight, Egbert is stated to be the descendant of the apochryphal Hengest and Horsa; and alongside stands another robust trunk springing from Kenneth II. King of Scots ; who is stated under the date of 843 to have been " first king of all Scotland ;"—though if that means all that was embraced in the Scotland of the Bruces and the Stuarts, it is an anachronism. The third substantial tree begins with Rollo, Duke of Normandy, and his first wife Popa,—by mistake here called Topa,—from whom proceeds William I. the Conqueror ; though the intermediate Dukes of Normandy are represented in a very maimed fashion, by three : "William," "Richard I," and then " Robert, who died on pilgrimage." A complete and accurate genealogy of the succession of the Dukes of Normandy would have been a useful addition to such a chart, and should either be complete, or else omitted. The three distinct genealogical trees, branching out, and frondent with leaves of oak, on which the various descents and alliances are blazoned, are represented as intertwining and uniting their branches. In strict accuracy, a fourth trunk, for the Danish Sweno and his Royal descendants would have been required. Instead of this the Danish line is made to spring as a branch from the Anglo-Saxon trunk. But such earlier difficulties and complications got over,—the Norman and Anglo-Saxon trunks are at length seen to unite at the Conquest, and to shoot up a vigorous stem, with needful Lancastrian, York, and Tudor ramifications; while alongside of it flourishes the separate Scottish tree, until their branches also coalesce in the union of the Scottish James IV., with Margaret Tudor; and at length in their great-grandson the whole ramifications are seen concentrated in the line of the Royal Stuarts; and the later fortunate Hanoverian stem. Crowning the topmost branch of the flourishing Genealogical Oak-tree, appears our loved Queen Victoria's name, with the dates of her birth, accession, and marriage; and a branching series of leaflets, bearing the names of Albert Edward Prince of Wales, the Princess of Prussia, and all the other royal children. The chart is very creditably executed, and coloured so as to present an attractive appearance, well calculated to invite the attention of the youthful students of our schools, and so to engage their study, and pleasantly secure the acquirement of some important facts and dates in British History.

*Descriptions of new Lower Silurian (Primordial), Jurassic, Cretaceous, and Tertiary Fossils, collected in Nebraska, &c., &c.* By F. B. Meek and F. V. Hayden.

*Descriptions of new Cretaceous Fossils from Nebraska Territory.* By F. B. Meek and F. V. Hayden.

*Descriptions of new Cretaceous Fossils from Texas.* By B. F. Shumard, M.D.

*On the Outline on the Head of the Comet of Donati.* By Professor Bond.

*Astronomical Notices: On the Proper Motion of Sirius in Declination.* By T. H. Safford, Assistant at the Observatory of Harvard College.

Our restricted space will only allow us, at present, to give the titles of these latter publications.

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## CANADIAN INSTITUTE.

### ANNUAL REPORT OF THE COUNCIL FOR THE YEAR 1861.

The Council of the Canadian Institute have the honor to present the following Report of the proceedings of the Society for the past year:

Since the last Annual Report twenty-seven new members have been added to the society; on the other hand there has been from various causes a loss of twenty-five; there has been therefore an increase of two in the total number at present on the books. This is a slight improvement on the statistics of last year, and the Council earnestly hope that the efforts of those who take an interest in the Society's operations, will be such as to enable a still more favourable report to be given at the close of the ensuing year.

The present state of the membership is as follows:

| | | |
|---|---|---|
| Members at commencement of Session, 1860-61 | | 462 |
| New members elected, Session 1860-61 | | 22 |
| By the Council during recess—1860-61 | | 5 |
| Total | | 489 |
| Deduct—Deaths | 5 | |
| Withdrawn | 14 | |
| Left the Province | 6 | |
| | — | 25 |
| Total 30th November, 1861 | | 464 |
| Composed of Honorary Members | | 5 |
| Life Members | | 34 |
| Corresponding Members | | 6 |
| Members | | 409 |
| Junior Members | | 10 |
| Total | | 464 |

## COMMUNICATIONS.

The following list of Papers, read at the Ordinary Meetings held during the Session, will be found to contain many communications of value, and some of general interest:

1st December, 1860.

Rev. Prof. W. Hincks, F.L.S., "On Ferns."

8th December, 1860.

Prof. T. Sterry Hunt, F.R.S., Verbal communication "On the Laurentian System of Canada and Scotland."

Prof. D. Wilson, LL.D., "On some traces of Ancient Art and Civilization in the Valley of the Ohio."

15th December, 1860.

Prof. E. J. Chapman, "On some new facts regarding Stelliform Crystals, with special reference to the Crystallization of Snow."

12th January, 1861.

Walter Arnold, Esq., "On an inconvertible paper currency for Canada."

19th January, 1861.

Patrick Freeland, Esq., "On the Movements of the Diatomaceæ, with illustrations of living specimens under the microscope."

A. E. Williamson, Esq., "On some Fresh-Water Molluscs, collected in the neighbourhood of Toronto."

26th January, 1861.

J. F. Smith, Jr., Esq., "On a new species of Triarthrus (=T. Canadensis)."

Rev. Prof. W. Hincks, F.L.S., "On some additions to the Flora of Toronto, observed during the past year."

2nd February, 1861.

C. Robb, Esq., Civil Engineer, "On the Petroleum Springs of Canada West."

T. Sterry Hunt, F.R.S. "On the Theory of Types in Chemistry."

9th February, 1861.

Rev. Prof. Hatch, B.A., "On the Gutturals in the Latin Alphabet and their Indo-European affinities."

Prof. D. Wilson, LL.D., (President), "Familiar notes and illustrations of the Hebridian Islands and their inhabitants."

16th February, 1861.

Dr. W. Kerr, Galt, "On the efficacy of some Canadian plants in diseases of the Mucous Membrane."

Prof. G. T. Kingston, M.A., "The Meteorological Report for 1860."

23rd February, 1861.

T. C. Wallbridge, Esq., "On the Mound Structures of Southern Illinois and Ohio in the vicinity of St. Louis, Cincinnatti, and Newark."

Rev. Prof. W. Hincks, F.L.S., "An attempt at a new theory of human emotions.

Prof. T. Sterry Hunt, F.R.S., "On the Nature of Atmospheric Nitrogen and Ozone."

2nd March, 1861.

Rev. Prof. Hatch, B.A,, "On Arabian Metaphysics."

Sandford Fleming, Esq., Civil Engineer, "Notes on the Davenport Gravel Drift."

9th March, 1861.

Henry Palmer, Esq., "A new portable Voltaic Battery, invented by himself."

Prof. Croft, D.C.L., "Notes on Canadian Manufactures."

16th March, 1861.

Prof. E. J. Chapman, (1) "Some notes on the drift deposits of Western Canada," and (2) "Remarks on the Genus Orthoceras, in illustration of a remarkably large example recently obtained from the Trenton Limestone of Collingwood."

23rd March, 1861.

Dr. Woods, Army Medical Department, "On Sanitary Science in connection with Human Progress."

Rev. Prof. W. Hincks, F.L.S., "Note on the Structure of the fruit in the Order Asteracæ or Compositæ."

6th April, 1861.

Rev. Prof. W. Hincks, F.L.S., "An attempt at an improved scientific arrangement of Fruits."

The foregoing list will show that the range of subjects within the province of the Institute is sufficiently wide to give any one who has a speciality in either literature or physical science an opportunity of interesting others in his researches, and of communicating them to those whose acquaintance with the same or cognate subjects may throw light upon their value. The Council, therefore, beg again to urge upon the members the importance of their active co-operation, in order that the weekly meetings may be a fair representation of the literary and scientific activity of the Province.

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The following is the

## REPORT OF THE EDITING COMMITTEE.

On the completion of the sixth annual volume of the New Series of the Canadian Journal, the Editing Committee have the honor to submit the annexed Report to the Council of the Institute:—

The Committee trust that the favorable character won, both in Canada and in foreign circles, by the Journal in former years, will continue to be maintained by the volume now completed. In this volume, thirty original communications on various branches of scientific inquiry, have been laid before the Institute and the readers of the Journal. Nineteen of these communications, distributed about equally through the six numbers of the volume, refer to purely Canadian subjects, and thus serve to impart to the Journal a desirable character of nationality. In proof of the value attached to these and to the other articles of this department, it may be observed that several have been thought worthy of a place in European scientific journals of long established reputation.

The Reviews, in the present volume, are less numerous than usual; amounting to only six in number. Their place has been in part supplied by the greater length of the original communications, and partly by a series of translated and selected articles. Amongst these, there will be found translations of several papers of much importance, chiefly from the *Comptes Rendus* of the French Academy of Sciences; and the selected articles, extracted from the Proceedings of the Royal Society and other less accessible sources, will add, it is thought, to the interest and value of the Journal. In making these extracts, care has been taken, as much as possible, to select articles of a readable and generally interesting character. Whilst the reviews, properly so-called, however, occupy but a small space, the volume contains a considerable number of critical notices and analyses of various publications, forwarded to the Journal by American and European writers. All the new publications received in this manner have been thus acknowledged.

The department of "Scientific and Literary Notes" continues to be kept up. In the present volume it contains, together with numerous extracts, several pages of original matter in the form of brief analytical notices of new announcements and discoveries. A more active co-operation on the part of the members of the Institute generally, is much to be desired in this, as well as in the other departments of the Journal.

During the preceding year, in addition to the Societies and Libraries previously in correspondence with the Institute, and enumerated in the last Report, the following have been placed upon the exchange list:—The Literary and Philosophical Societies of Liverpool and Manchester, and the Library of Trinity College, Dublin.

The cost of the Journal for the past year, including printing and engravings, as amounted to $1291. This sum is of about the usual average, as compared with the expenses of former years.

EDWARD J. CHAPMAN, *General Editor.*

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The following is the Report of the Treasurer, from which it will be seen that the financial condition of the Institute continues to be satisfactory:—

DR.] *Statement of the Canadian Institute General Account for* 1861.

| | | | |
|---|---|---|---|
| Cash balance from last year | | £394 17 2½ | |
| " received from Members | | 217 2 5 | |
| " " for Journals, Old 2s. 6d., New £53 10d. | | 53 3 4 | |
| " " for interest on loans | | 96 5 0 | |
| " " Parliamentary Grant, 1861 | | 250 0 0 | |
| " Due by Members | | 395 1 1 | |
| " for sale of old Journal, £28 5s., new £52 11s. 3d. | | 80 16 3 | |
| | | | £1487 5 3½ |

CR.]

| | | | |
|---|---|---|---|
| Cash paid on account of Journal, 1860 | £135 11 9 | | |
| " " " 1861 | 250 0 8 | | |
| | | 385 12 5 | |
| " paid Library and Museum | | 63 17 2 | |
| " " on account of Sundries | | 263 18 5 | |
| " Due on account of Journal | | 72 14 0 | |
| " " " Sundries | | 31 10 8 | |
| " " " Library | | 17 7 1 | |
| Estimated balance in favor of Institute | | 652 5 6½ | |
| | | | £1487 5 3½ |

*Statement of Building Fund.*

| | | |
|---|---|---|
| Balance from last year | £1942 6 9 | |
| Received interest on loans | 96 5 0 | |
| Subscriptions (uncollected) | 534 15 0 | |
| | | £2573 6 9 |

DR.] *The Treasurer in Account with the Canadian Institnte.*

| | | |
|---|---|---|
| Cash balance last year | £394 17 2½ | |
| Securities | 1425 0 0 | |
| Interest received on securities | 96 5 0 | |
| Cash received from Members | 217 2 5 | |
| " on account of Journals sold | 53 3 4 | |
| " Parliamentary Grant, 1860 | 250 0 0 | |
| " " " 1861 | 250 0 0 | |
| | | £2686 7 11½ |

| Cr.] | | | |
|---|---|---|---|
| Cash paid for Journal, 1860 | £135 11 9 | | |
| " " " 1861 | 250 0 8 | £385 12 5 | |
| " " Library Museum | | 63 17 2 | |
| " " on account of Sundries | | 263 18 5 | |
| Securities | | 1500 0 0 | |
| Balance | | 472 19 11½ | |
| | | | £2686 7 11½ |

D. Crawford,
*Treasurer C. I.*

Toronto, 6th Dec., 1861.

Compared vouchers with Cash Book, securities for investments exhibited, the balance in hands of Treasurer £472 19s. 1½d.

Samuel Spreull, }
G. H. Wilson, } *Auditors.*

The number of volumes added to the library during the year is *one hundred and sixty-three.* Of these *sixty-seven* are donations, the rest have been obtained by purchase and binding periodicals. A detailed list will be found appended to this report.

At the close of the last Session, on April 26th, the Council invited the members and friends of the Institute to a Conversazione in the Masonic Hall, the use of which was kindly granted for the occasion. The attendance was such as to afford a gratifying proof of the general interest which is taken in the proceedings of the Society. The Council hope that it may be found possible to hold a meeting of a similar character in the course or at the close of the present session, and that the aid of those gentlemen, to whose efforts the success of the previous one was mainly due, may again be obtained, in order that its results may be equally satisfactory.

Two other subjects have engaged the attention of the Council during the past year. The one has been the endeavour to secure an adequate representation of Canada at the Universal Exhibition of 1862. For this purpose a Committee was appointed, but in the absence of any reply to the memorial which was addressed to the Government on the subject, it has been impossible to take definite action. The other has been the endeavour to find a more fitting local habitation for the Society. The Council beg to report, that after many fruitless attempts they have at last succeeded in obtaining the promise of rooms which, though still affording but temporary accommodation, will yet be more convenient, more commodious, and more suitable to the position of the Society.

The Council beg in conclusion to say, that a review of the past year leads them to the conclusion that the condition of the Institute is quite as satisfactory as the general state of the Province would lead them to expect. It may not exhibit year by year any definitely marked advance, but it is at least able to keep pace with the general march of science, and to maintain the high character which it has always held among the learned societies of the continent.

## APPENDIX.

### DONATIONS OF BOOKS, MAPS, &c.

Marked thus * not bound, or pamphlets.

Government Map of Canada, 1859. From the Red River to the Gulf of St. Lawrence; compiled by T. Devine, P.L.S., Head of Surveys, Upper Canada Branch Crown Lands Department, Nov., 1859. From Author ... 1

FROM SIR. J. B. ROBINSON, BART.

Contributions to the Natural History of the United States of America; by Louis Agassiz. Vol. III........................................ 1

FROM W. HAY, ESQ., ARCHITECT.

British Columbia and Vancouver's Island, with a Map; by W. C. Hazlett.... 1

Tales, Sketches, and Lyrics; by the Rev. R. J. Macgeorge ................ 1

FROM HON. G. W. ALLAN, M.L.C.

Gould's Trochilidæ. Parts 19 and 20.................................... 2

FROM THE HON. EAST INDIA COMPANY, LONDON.

Magnetical and Meteorological Observations, made at the Government Observatory, Bombay, year 1858, under the Superintendence of Lieut. E. F. T. Fergusson, Indian Navy, F.R.A.S.................................... 1

FROM REV. C. J. S. BETHUNE, B.A.

Pictorial Atlas of Fossil Remains; by G. A. Mantell, Esq., LL.D., F.R.S..... 1

FROM SUPERINTENDENT OF EDUCATION, LOWER CANADA.

Journal of Education, Lower Canada. 1860 ............................. 1

Journal de L'Instruction Publique, Bas Canada. 1860 ......... .......... 1

FROM J. D. CAMPBELL, ESQ., TORONTO.

The North American Review. 1854 to June, 1860, in numbers.............13*

FROM THE ROYAL SOCIETY OF EDINBURGH.

The Proceedings of, Session 1859-60. Vol. IV. 1859-60. No 50......... 1*

The Transactions of, Session 1859-60. Vol. XXII. Part II................ 1*

Appendix to the Makerstoun Magnetical and Meteorological Observations, being a supplement to Vol. XXII. of the Transactions of the Royal Society of Edinburgh (Continued from Vol. XIX.); reduced and edited by Balfour Stewart, M.A., Director of the Kew Observatory............ 1*

FROM THE LITERARY AND PHILOSOPHICAL SOCIETY, MANCHESTER.

Memoirs of the Literary and Philosophical Society of Manchester. Vol. XV. 2nd Series; Vol. XX. old series...................................... 1

FROM JAMES BAIN, JR., ESQ., TORONTO.

The Poor Laws and their bearing on Society, a Series of Political and Historical Essays; by Eric Gustaf Geijer. Professor of History at the University of Upsala .................................................. 1

Acta Literaria Sveciæ Upsaliæ publicata, Volumen Secundum continens. annos 1725, 1726, 1727, 1728, et 1729.............................. 1

### From Capt. Meade, Superintendent of the U. S. Lake Survey.

| | |
|---|---|
| Report of the Superintendent of the United States Lake Survey. 1860 | 1 |

### From the Hon. J. M. Brodhead, Washington, D. C.

| | |
|---|---|
| Patent Office Reports. 1859, Agriculture, 1; Mechanics, Vol. I. and II., 2 | 3 |

### From the Smithsonian Institute, Washington, D. C.

| | |
|---|---|
| Contributions to Knowledge. Vol. XII | 1 |

### From L. Scott & Co., New York.

| | |
|---|---|
| Reviews—Westminster, Edinburgh, London, and North British Quarterlies, Blackwood's Magazine, for 1861 | |

### From Bt. Lieut. Col. Graham, U. S. Topographical Engineers.

| | |
|---|---|
| Annual Report on the improvement of the Harbors of Lake Michigan, St. Clair, Erie, Ontario, and Champlain, for the year 1860 | 1 |

### From the Office of Routine and Record.

| | |
|---|---|
| The Statutes of Canada. 1861 | 1 |

### From the United States Patent Office, Washington.

| | |
|---|---|
| Patent Office Reports. 1858. Mechanics, Vols. I., II., and III | 3 |
| " " " " Agriculture, Vol. I | 1 |
| " " " 1859. Mechanics, Vol. I. and II | 2 |
| " " " " Agriculture, Vol. I | 1 |

### From S. T. Abbott Evans, Esq., P.L.S., L'Original, C. W., (Author).

| | |
|---|---|
| A map of (Plan) of the United Counties of Prescott and Russell. Completed by order of the County Council. Scale, 30 chains or one mile to an inch | 1 |

### From the Society, per Smithsonian Institute.

| | |
|---|---|
| Proceedings of the Liverpool Literary and Philosophical Society, during the 49th Session, 1859–60. No. XIV | 1* |
| " " 1860–61. No. XV | 1* |

### From H. G. Bohn, Esq., London.

| | |
|---|---|
| Danish Fairy Tales and Legends; by Hans Christian Andersen, Translated by Caroline Peachey, &c. 1861 | 1 |
| The Poetical Works of Henry Wadsworth Longfellow, including his translations and notes | 1 |
| Milton's Poetical Works. Vol. I., Paradise Lost, &c | 1 |
| " " " Vol. II., Paradise Regained, &c | 1 |
| The Philosophy of Manufactures, or an exposition of the Scientific, Moral and Commercial Economy of the Factory System of Great Britain; by Andrew Ure, M.D., F.R.S. 3rd edition | 1 |
| The Cotton Manufacture of Great Britain Investigated and Illustrated, &c., &c.; by the late Andrew Ure, M.D., F.R.S. Vols. I. and II | 2 |
| The Letters and Works of Lady Mary Wortley Montagu; by her grandson, Lord Wharncliffe. 3rd edition. 2 Vols., Vol. I | 1 |
| The Works of Virgil; translated by Charles Rann Kennedy | 1 |

FROM THE GEOLOGICAL SURVEY OF INDIA.

| | |
|---|---|
| Geological Survey of India. Vol. II., Part 2 | 1* |
| Annual Report of Geological Survey of India. 1859-60. 4th year | 1* |

FROM THE ROYAL GEOGRAPHICAL SOCIETY, PER H. ROWSELL.

| | |
|---|---|
| Proceedings of May 25th, 1857, President's Anniversary Address, No. X | 1* |
| “ June, 1857, Vol. I. “ “ No. XI | 1* |
| “ January, 1858, Vol. II. “ “ No. I | 1* |
| “ March, “ “ “ “ No. II | 1* |
| “ June, “ “ “ “ No. III | 1* |
| “ July, “ “ “ “ No. IV | 1* |
| “ May 24th, Address at the Anniversary Meeting, No. V | 1* |
| “ October, 1858, Vol. II. “ “ No. VI | 1* |
| “ March, 1859, Vol. III. “ “ No. IV | 1* |
| “ June, “ Vol. III. “ “ No. VI | 1* |
| “ Nov., “ Vol. IV. “ “ No. I | 1* |
| “ January, 1860 “ “ “ No. II | 1* |
| “ March, “ “ “ “ No. III | 1* |
| “ May, “ “ Anniversary Meeting No. IV | 1* |
| “ June, “ “ “ “ No. V | 1* |
| “ Nov., “ Vol. V. “ “ No. I | 1* |
| “ Dec.. “ “ “ “ No. II | 1* |
| “ February, 1861 “ “ “ No. III | 1* |
| Journal, Vol. XXVII. 1857 | 1* |
| “ Vol. XXVIII. 1858 | 1* |
| “ Vol. XXIX. 1859 | 1* |
| “ Vol. XXX. 1860 | 1* |

FROM THE ROYAL ASIATIC SOCIETY OF GREAT BRITAIN AND IRELAND, PER H. ROWSELL, ESQ.

| | |
|---|---|
| Journal, Vol. XVII. Part 1. 1859 | 1* |
| “ “ “ 2. 1860 | 1* |
| “ Vol. XVIII. “ 1. 1860 | 1* |
| “ “ “ 2. 1861 | 1* |

FROM THE GEOLOGICAL SOCIETY OF LONDON, PER H. ROWSELL, ESQ.

| | |
|---|---|
| The Anniversary Address of the President, Col. Portlock, R.E. 1857 | 1* |
| Quarterly Journal. Vol. XIII. Part 2. May, 1857. No. 50 | 1* |
| “ “ “ 3. Aug., “ No. 51 | 1* |
| “ “ “ 4. Nov., “ No. 52 | 1* |
| Abstract of Proceedings, No. 1 and 2, Session 1856-7. Pages 1-12 | 2* |
| Quarterly Journal. Vol. XIV. Part 1. February, 1858. No. 53 | 1* |
| The Anniversary Address of the President, Major General Portlock, R. E. | 1* |
| Quarterly Journal. Vol. XIV. Part 2. May, 1858. No. 54 | 1* |
| “ “ “ 3. Aug., “ No. 55 | 1* |
| “ “ “ 4. Nov., “ No. 56 | 1* |

| | | | | | |
|---|---|---|---|---|---|
| Quarterly Journal, | Vol. XV. | " 1. | Feb., 1859 | No. 57 | 1* |
| " | " | " 2. | May, " | No. 58 | 1* |
| " | " | " 3. | Aug., " | No. 59 | 1* |
| " | " | " 4. | Nov., " | No. 60 | 1* |
| " | Vol. XIV., | Part 5. | Feb., 1860 | (Supplement) No. 60 | 1* |
| " | Vol. XVI. | " 1. | Feb., 1860 | No. 61 | 1* |
| " | " | " 2. | May, " | No. 62 | 1* |
| " | " | " 3. | Aug., " | No. 63 | 1* |
| List of the Geological Society, 1st September, 1860 | | | | | 1* |
| Quarterly Journal. | Vol. XVI. | Part 4. | Nov., 1860. | No. 64 | 1* |
| " | Vol. XVII. | " 1. | Feb., 1861. | No. 65 | 1* |
| " | " | " 2. | May, " | No. 66 | 1* |
| " | " | " 3. | Aug., " | No. 67 | 1* |

### From the Author.

| | |
|---|---|
| Visit of His Royal Highness the Prince of Wales to Canada, 1860. By Eusèbe Sénécal. French, 1 ; English, 1 | 2 |

### From Henry G. Bohn, Esq., London, per Rev. E. Ryerson, D.D., Toronto.

| | |
|---|---|
| The Letters and Works of Lady Mary Wortley Montagu. Edited by her grandson, Lord Wharncliffe. Vol. II | 1 |
| The Life of Lord Nelson ; by Southey. New Edition. London: 1861 | 1 |
| The Pirate and the Three Cutters ; By Captain Marryat, R. N | 1 |
| Elements of Experimental and Natural Philosophy ; by Jabez Hogg, F.L.S., &c. | 1 |
| The Orations of Demosthenes. Illustrated by Charles Rann Kennedy | 1 |

## DONATIONS OF PAMPHLETS, SHEETS, &c.

### From Rev. S. Haughton, M.A., Dublin (Author).

| | |
|---|---|
| On Cyclostigma—a new Genus of Fossil Plants from the Old Red Sandstone of Kiltorcan, Co. Kilkenney | 1 |
| Fossils from the Arctic Regions brought by Captain Sir F. L. McClintock in 1859 | 1 |

### From Harvard College, Boston.

| | |
|---|---|
| Report of the Committee of the Overseers of Harvard College appointed to visit the Library, for the year 1860 | 1 |

### From Professor James Hall, Albany, N. Y.

| | |
|---|---|
| Thirteenth Annual Report of the Regents of the University of the State of New York, on the Condition of the State Cabinet of Natural History, and the Historical and Antiquarian Collection annexed thereto | 1 |

### From George D. Gibb, Esq., M.D., London, (Author.)

| | |
|---|---|
| On Canadian Caverns (Read before the British Association for the Advancement of Science, at Aberdeen, 16th September, 1859) | 1 |

### From George Lawson, Ph. D., Kingston, C. W.

| | |
|---|---|
| On the Structure and Development of Botrydium Granulatum | 1 |
| Annals of the Botanical Society of Canada. Vol. I., Part II; March 8th to 28th, 1861 | 1 |

| | |
|---|---|
| FROM BREVET LIEUT. COL. J. D. GRAHAM, U. S. TOPOGRAPHICAL ENGINEERS. | |
| A Lunar Tidal Wave in Lake Michigan Demonstrated (with Plates.) | 1 |
| FROM B. DAWSON & SON, PUBLISHERS, MONTREAL, C. E. | |
| Tables of Measures, English, Old French and Metrical, 1861 | 1 |
| FROM PROFESSOR J. W. DAWSON, LL.D., F.G.S., &c. | |
| On the Carboniferous Flora of New Brunswick, Maine and Eastern Canada | 1 |
| FROM THE UNITED STATES PATENT OFFICE, WASHINGTON. | |
| Patent Laws | 1 |
| Rules and Directions for Proceeding in the Patent Office | 1 |
| FROM THE SUPERINTENDENT OF EDUCATION, LOWER CANADA. | |
| Rapport de l'Education Pour le Bas Canada, pour l'Année 1860 | 1 |
| Report of Superintendant of Education for Lower Canada, year 1860 | 1 |
| FROM EDITORS OF SILLIMAN'S AMERICAN JOURNAL. | |
| The Great Comet, 1861. (Sheets in advance.) | 1 |
| FROM THE UNIVERSITY OF CHRISTIANIA—NORWAY. | |
| Solennia Academica Universitatis Literariæ Regiae Fredericianæ ante LAnnos conditæ die, 11 Septembris Anne MDCCCLXI., celebranda Indicit Senatus academicus (sheets) | 1 |
| FROM T. O. WEIGEL, LEIPZIG, PER SMITHSONIAN INSTITUTE. | |
| XI. Katalog Naturwissenschaftlicher Werke aus dem Antiquarischen Lager. Von T. O. Weigel, Leipzig | 1 |
| Kleine Schriften der Naturforschenden Gesellschaft in Emden, VI. and VII. | 2 |
| Fünfundvierzigster Jahresbericht der Naturforschenden Gesellschaft in Emden, 1840. Von Docr. H. Metger, Secretar | 1 |
| FROM B. QUARITCH, LONDON. | |
| Catalogue Raisonné of rare and valuable Books | 10 |
| FROM THE HISTORICAL SOCIETY OF CHICAGO, ILL., U. S. | |
| Memorial to the United States Government from the citizens of Chicago, Ill., setting forth the advantages of that City as a site for a National Armory and Foundry, Nov., 1861 | 1 |
| FROM THE AUTHOR. | |
| New Species of Lower Silurian Fossils. By E. Billings, F.G.S., &c. | 1 |
| FROM HENRY G. BOHN, ESQ., LONDON. | |
| Catalogue of New, Valuable and most Important Books | 1 |
| IN EXCHANGE FOR JOURNAL. | |
| The Journal of Education for Upper Canada, 1861, (Duplicate) | 1 |
| The Journal of the Franklin Institute, Philadelphia | 1 |
| The Artizan, London, 1861 | 1 |
| The Journal of the Society of Arts, 1861 | 1 |
| Silliman's American Journal, 1861 | 1 |
| Canadian Naturalist and Geologist, 1861 | 1 |
| Proceedings of the Boston Natural History Society, 1861 | 1 |
| Journal of Education, Lower Canada, 1861 | 1 |

| | |
|---|---|
| Journal de l'Instruction Publique, Lower Canada, 1861 | 1 |
| The Journal of the Geological Society of Dublin, 1861 | 1 |
| The Dublin Quarterly Journal of Science, 1861 | 1 |
| The proceedings of the Academy of Natural Sciences, Philadelphia. Pages 517–597, with index, 1–48, with catalogue of fishes, 65–144 | 1 |
| Proceedings of the Essex Institute, Vol. II., Part 2, 1857–1859 | 1 |
| Historical Recollections “ Vol. III No. 1, 2 and 3 | 1 |
| Annales Des Mines, &c., France, Vme Serie: | |
| Tome XVIII., 4th Livraison de 1860 | |
| “ “ 5th “ “ | 1 |
| “ “ 6th “ “ | 1 |
| “ XIX., 1st “ 1861 | 1 |
| “ “ 2nd “ “ | 1 |
| The Journal of the Royal Dublin Society, Nos. 18 and 19, July and Oct., 1860, | 1 |
| Transactions of the Royal Scottish Society of Arts, Vol. V., Part 4 | 1 |
| Proceedings of the American Antiquarian Society, Boston | 1 |
| Canadian Agriculturist, 1861 | 1 |
| Annals of the Lyceum of Natural History, New York, Vol. VII., Nos. 4–9, April and May, 1860 | 1 |
| Journal of the Board of Arts and Manufactures, Toronto, 1861 | 1 |

## BOOKS PURCHASED.

| | VOLS. |
|---|---|
| Crania Britannica, &c. &c. By J. B. Davis. Decade IV. | 1 |
| First Principles, No. 1. Number | 1 |
| The Works of Bacon. Vols. 11, 12, 13, 14, 15, and 1 | 6 |
| Encyclopædia Britannica. 8th ed. vol. 21. T—Zwo | 1 |
| ———————— Index to 8th edition | 1 |
| The Rise of the Dutch Republic. By J. L. Motley. Vols. 1, 2, and 3 | 3 |
| The Life of Doctor Scoresby. By R. E. Scoresby Jackson, M.D., &c. | 1 |
| The Year Book of Facts, 1861 | 1 |
| Memoir of George Wilson, M.D., F.R.S.E. By his sister, Jessie Aitken Wilson | 1 |
| Motley's History of the United Netherlands. Vols. 1 and 2 | 2 |
| Archæology and Prehistoric Annals of Scotland. By Daniel Wilson, Honorary Secretary of the Society of Antiquaries of Scotland | 1 |
| Preadamite Man; or, The Story of our Old Planet and Its Inhabitants, told by Scripture and Science. 3rd edition. London; Saunders, Otley, and Co. 1860 | 1 |
| Adventures in Equatorial Africa. By P. B. Du Chaillu | 1 |
| Hind's Narrative | 2 |
| Whewell's Plato. Vols. 1 and 2 | 2 |
| Life of Lord Dundonald. Vols. 1 and 2 | 2 |
| Memoir of Edward Forbes, F.R.S., &c. By George Wilson, F.R.S.E. &c | 1 |
| History of Civilization in England. By Henry Thomas Buckle. Vol. 2 | 1 |

| | |
|---|---|
| Phillip's Life on the Earth | 1 |
| Kohl's Lake Superior | 1 |
| Phillip's Yorkshire | 1 |
| Farrar's Essay | 1 |
| Mediæval Scottish History. By Cosmo Innes | 1 |
| Early Scottish History. By Cosmo Innes | 1 |
| Mexico and the Mexicans | 1 |
| The Okavango River—Travel in Africa. By Charles John Anderssen | 1 |

## DONATION TO THE MUSEUM.

### From H. Palmer, Esq.

| | |
|---|---|
| Electro Voltaic Pocket Battery for Medical Use, patented 16th January, 1861. | 1 |

## BOOKS BOUND FROM PERIODICALS RECEIVED, &c.

| | |
|---|---|
| Reviews, North British Quarterly. 1858–59–60 | 3 |
| ———— London Quarterly. 1858–1859 | 2 |
| ———— Edinburgh Quarterly. 1858–60 | 2 |
| ———— Westminster. Quarterly. 1860 | 1 |
| Blackwood's Magazine. January–June, 1861 | 1 |
| Hunt's Merchants' Magazine. July–December, 1860; January–June, 1861 | 2 |
| Mining Journal. Vol. 30. 1860 | 1 |
| Illustrated London News. 1860, 2 vols.; 1861, 1 vol. | 3 |
| Silliman's American Journal. 1859, 2 vols.; 1860, 2 vols. | 4 |
| Civil Engineers and Architects Journal. 1860 | 1 |
| Quarterly Journal of the London Geological Society. Vols. 15 and 16 | 2 |
| Annales des Mines | 4 |
| London, Edinburgh, and Dublin Philosophical Magazine. 1860, 2 vols.; 1861, 1 vol. | 3 |
| Journal of the Franklin Institute. 1860 | 2 |
| Edinburgh New Philosophical Magazine. 1857–60–61 | 4 |
| Builder. 1859–60 | 2 |
| Athenæum. July–December, 1860; January–June, 1861 | 2 |
| North American Review. 1854–55–56–57–58–59, two vols. each; 1860–61, one vol. each | 14 |
| Canadian Journal. 1856–57–58–59–60, New Series, two vols. each | 10 |
| ———————— Vol. 2, Old Series | 2 |
| ———————— Vol. 3, Old Series | 2 |
| Journal of the Royal Geographical Society of London. 1857. Vol. 27 | 1 |
| ———————————————— 1858. Vol. 28 | 1 |
| Art Journal for 1860 | 1 |
| Artizan for 1860 | 1 |

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—DECEMBER, 1861.

*Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 m. 33 s. West. Elevation above Lake Ontario, 108 feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Average | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resul't. Direction. | Velocity of Wind. | | | | | Rain in inches. | Snow in inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | Mean. | 6 A.M | 2 P.M | 10PM | ME'N | | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A. M. | 2 P. M. | 10 P. M. | | 6 AM. | 2 PM. | 10 P.M. | Re-sul't. | ME'N | | |
| | | | | | ° | ° | ° | ° | ° | | | | | | | | | | | | ° | | | | | | | |
| 1 | 29.476 | 29.320 | — | — | 27.0 | 28.4 | — | — | — | .129 | .142 | — | — | .88 | .90 | — | — | W b S | Calm. | W N W | W | 0.2 | 0.0 | 2.5 | 1.91 | 1.87 | ... | 3.0 |
| 2 | .523 | .564 | 29.643 | 29.5880 | 16.5 | 25.9 | 17.6 | 19.98 | —10.50 | .083 | .107 | .083 | .090 | .90 | .76 | .85 | .83 | W b S | W | W N W | N 75 W | 3.2 | 12.0 | 2.8 | 5.47 | 6.41 | ... | Inp. |
| 3 | .777 | .834 | .851 | .8268 | 13.2 | 20.8 | 10.7 | 14.25 | —15.83 | .066 | .077 | .064 | .068 | .83 | .69 | .92 | .83 | N W b N | N W b N | N | N 23 W | 10.5 | 5.2 | 1.5 | 3.71 | 3.84 | ... | Inp. |
| 4 | .815 | .685 | .633 | .7142 | 18.3 | 31.6 | 34.2 | 28.03 | — 1.75 | .093 | .148 | .152 | .133 | .94 | .83 | .77 | .85 | W N W | S W b S | S W | S 42 W | 4.0 | 12.2 | 15.0 | 9 98 | 10.23 | ... | ... |
| 5 | .741 | .843 | .960 | .8622 | 30.6 | 38 3 | 36.7 | 34.63 | + 5.27 | .141 | .142 | .179 | .156 | .85 | .61 | .82 | .77 | Calm. | Calm. | N E | N 72 E | 0.0 | 0.0 | 3.5 | 2.31 | 2.37 | Inp. | ... |
| 6 | .994 | .932 | .902 | .9373 | 38.8 | 45.4 | 42.1 | 41.92 | +12.85 | .220 | .253 | .249 | .237 | .94 | .83 | 93 | .89 | E b N | E S E | Calm. | S 23 E | 3.0 | 2.0 | 0.0 | 0.90 | 1.76 | ... | ... |
| 7 | .818 | .678 | .560 | .6740 | 45.7 | 50.4 | 48.9 | 47.92 | +19.25 | .278 | .299 | .329 | .299 | .90 | .81 | .94 | .89 | S W b W | S S W | S W | S 38 W | 3.5 | 15.0 | 5.0 | 6.24 | 6.37 | 0.210 | ... |
| 8 | .556 | .540 | — | — | 49.0 | 55.1 | — | — | — | .326 | .399 | — | — | .94 | .91 | — | — | S W | S W | N E b E | S 54 W | 0.4 | 1.0 | 0.5 | 0.42 | 0.77 | ... | ... |
| 9 | .626 | .529 | .451 | .5347 | 44.3 | 44.3 | 46.1 | 44.60 | +16.45 | .278 | .283 | .292 | .279 | .95 | .97 | .94 | .94 | E N E | E | N E b E | N 69 E | 0.4 | 1.8 | 5.0 | 2.56 | 2.67 | Inp. | ... |
| 10 | .420 | .300 | .221 | .3305 | 45.0 | 52.9 | 54.4 | 48.45 | +20.60 | .288 | .381 | .396 | .329 | .96 | .95 | .93 | .95 | N E b E | S W b S | S W | N 73 W | 1 2 | 10.6 | 16.6 | 10.30 | 14.03 | 0.100 | ... |
| 11 | .674 | 30.024 | 30.142 | .9805 | 32 0 | 28.4 | 20.1 | 26.23 | — 1.42 | .128 | .077 | .079 | .092 | .71 | .49 | .73 | .64 | N W b W | N W | Calm. | N 49 W | 23.2 | 16.5 | 0.0 | 9.70 | 10.33 | ... | ... |
| 12 | 30.164 | 30.181 | 30.173 | 30.1730 | 24.8 | 35.6 | 31.6 | 30.68 | + 3.33 | .120 | .141 | .140 | .133 | .90 | .68 | .78 | .78 | W b S | S W | S W b W | S 54 W | 1.5 | 9.8 | 7.0 | 6.41 | 6.50 | ... | ... |
| 13 | 30.128 | 30.006 | 29.924 | 30.0075 | 32.0 | 40.1 | 33.4 | 35.15 | + 8.00 | .143 | .169 | .134 | .147 | .79 | .68 | .70 | .71 | W S W | S W b S | W | S 55 W | 7.5 | 6.5 | 1.6 | 4.29 | 4.35 | ... | ... |
| 14 | 29.765 | 29.664 | .850 | 29.7612 | 36.3 | 43.5 | 36.0 | 37.75 | +10.78 | .157 | .150 | .172 | .156 | .74 | .52 | .81 | .70 | S W | W S W | W N W | N 76 W | 5.0 | 4.8 | 8.6 | 5.79 | 7.04 | ... | ... |
| 15 | 30.113 | 30.058 | — | — | 29.8 | 34.9 | — | — | — | .096 | .131 | — | — | .58 | .65 | — | — | N W b N | S W b S | S W b W | S 60 W | 5.8 | 7.6 | 9.0 | 5.46 | 6.40 | ... | ... |
| 16 | 29.600 | 29.420 | .724 | .5905 | 38.1 | 50.0 | 40.7 | 42.45 | +15.88 | .213 | .184 | .180 | .195 | .93 | .49 | .70 | .72 | S W b W | W b S | N W b N | N 86 W | 12.7 | 20.5 | 7.0 | 9.18 | 12.46 | ... | ... |
| 17 | .856 | .795 | .504 | .7017 | 30.2 | 38.5 | 37.0 | 35.78 | + 9.42 | .128 | .173 | .167 | .160 | .76 | .74 | .75 | .75 | N b E | E S E | W b S | S 12 E | 5.0 | 6.6 | 4.5 | 2.80 | 7.14 | ... | ... |
| 18 | .646 | .776 | .837 | .7648 | 34.2 | 43.2 | 30.9 | 35.67 | + 9.50 | .160 | .128 | .127 | .141 | .81 | .45 | .73 | .69 | W | N W | N E b N | N 34 W | 7.8 | 11.5 | 4.5 | 3.05 | 6.85 | ... | ... |
| 19 | .690 | .418 | .475 | .5205 | 37.8 | 47.2 | 41.7 | 41.78 | +15 72 | .208 | .249 | .218 | .217 | .91 | .76 | .82 | .81 | S | S W | W N W | N 84 W | 3.3 | 6.6 | 10.5 | 8.56 | 10.83 | Inp. | ... |
| 20 | .607 | .803 | .998 | .8172 | 29.8 | 21.2 | 16 1 | 21.95 | — 3.93 | .162 | .072 | .062 | .092 | .98 | .63 | .68 | .73 | N W | N W b N | W b N | N 44 W | 23.5 | 21.5 | 15.0 | 13.27 | 15.04 | ... | 0.1 |
| 21 | 30.057 | 30.066 | 30.085 | 30.0718 | 12.5 | 22.1 | 13.2 | 16.48 | — 9.30 | .055 | .082 | .060 | .068 | .73 | .68 | .75 | .74 | N b E | W b S | Calm. | S 86 W | 5.0 | 11.0 | 6.0 | 5.33 | 6.26 | ... | ... |
| 22 | 30.037 | 29.879 | — | — | 15.4 | 27.1 | — | — | — | .070 | .120 | — | — | .80 | .81 | — | — | N W b W | E b N | N E b E | N 50 E | 10.0 | 7.0 | 9.2 | 7.58 | 8.52 | ... | 2.5 |
| 23 | 29.271 | .206 | 29.460 | 29.3332 | 25.9 | 26.2 | 21.2 | 23.73 | — 1.83 | .128 | .103 | .092 | .107 | .92 | .73 | .81 | .83 | N N E | N b W | N W b N | N 23 W | 13.4 | 15.4 | 21.0 | 15.62 | 16.71 | ... | 0.5 |
| 24 | .664 | .712 | .801 | .7407 | 13.6 | 16.5 | 8.5 | 11.68 | —13.80 | .072 | .076 | .060 | .068 | .90 | .83 | .93 | .91 | N W b W | N W b N | N | N 22 W | 5.0 | 12.0 | 7.2 | 7.01 | 7.61 | ... | ... |
| 25 | .833 | .840 | — | — | 11.8 | 24.8 | — | — | — | .063 | .098 | — | — | .86 | .73 | — | — | N b E | E S E | E b S | N 78 E | 7.5 | 12.2 | 13.0 | 8.40 | 9.49 | ... | ... |
| 26 | .736 | .465 | .242 | .4675 | 28.0 | 34.3 | 35.6 | 33.03 | + 7.73 | .131 | .194 | .193 | .173 | .86 | .98 | .93 | .91 | E b S | E b S | S S W | S 15 W | 10.4 | 9.5 | 15.0 | 5.41 | 14.29 | 0.250 | ... |
| 27 | .523 | .871 | 30.119 | .8738 | 28.7 | 25.2 | 20.5 | 24.02 | — 1.27 | .116 | .073 | .093 | .090 | .73 | .53 | .85 | .70 | W S W | N W b W | W b N | N 64 W | 23.5 | 36.0 | 5.5 | 18.33 | 20.27 | ... | 0.1 |
| 28 | 30.177 | 30.105 | 29.958 | 30.0717 | 10.7 | 19.4 | 24.4 | 18.22 | — 6.93 | .059 | .100 | .089 | .080 | .82 | .96 | .68 | .79 | N b W | E b N | E S E | N 88 E | 4 5 | 2.4 | 8.6 | 4.75 | 6.53 | ... | 0.6 |
| 29 | 29.735 | 29.709 | — | — | 27.3 | 29.1 | — | — | — | .118 | .118 | — | — | .79 | .73 | — | — | S E b E | N W | W b S | N 66 W | 9.4 | 1.0 | 8.0 | 3.72 | 6.15 | ... | ... |
| 30 | .883 | .916 | .888 | 29.9017 | 28.4 | 30.7 | 23.3 | 27.22 | + 2.05 | .105 | .106 | .103 | .105 | .66 | .62 | .82 | .71 | N W b N | W b N | Calm. | N 76 W | 10.2 | 5.0 | 0.0 | 3.38 | 5.24 | ... | ... |
| 31 | .669 | .392 | .223 | .4083 | 33.1 | 39.2 | 38.0 | 36.60 | +11.42 | .160 | .165 | .196 | .175 | .85 | .67 | .86 | .80 | S W | S W b S | S W b W | S 42 W | 10.5 | 8.5 | 12.5 | 8.44 | 8.56 | ... | ... |
| M | 29.7530 | 29.7274 | 29.7450 | 29.7461 | 29.14 | 34.84 | 30.52 | 31.13 | + 4.04 | .148 | .157 | .156 | .151 | .85 | .72 | .82 | .79 | ........ | ........ | ........ | ........ | 7.45 | 9.41 | 7.10 | ...... | 7.96 | 0.560 | 6.8 |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR DECEMBER, 1861.

Highest Barometer . . . . . . . 30.182 at 8 a. m. on 12th. } Monthly range=
Lowest Barometer . . . . . . . 29.171 at midn't on 31st. } 1.011 inches.

Self-registering Ther.
Maximum temperature . . . . 55°2 on p.m. of 10th } Monthly range=
Minimum temperature . . . . 5°5 on a.m. of 25th } 49°7
Mean maximum temperature . . 37°03 } Mean daily range=12°80
Mean minimum temperature . . 24°23 }
Greatest daily range . . . . . . . 26°4 from a. m. to p. m. of 4th.
Least daily range . . . . . . . . 2.2 from a. m. to p. m. of 23rd.

Warmest day . . 10th ...Mean Temperature . . .=48°45 } Difference=36°77.
Coldest day . . . 24th ...Mean Temperature . . .=11°68 }
Maximum { Solar . . . . . . . . . . 70°2 on p. m of 8th } Monthly range=
Radiation { Terrestrial . . . . . . . —2°6 on a. m. of 25th } 72°.8

Aurora observed on 4 nights, viz.: 1st, 4th, 20th, and 21st; Possible to see Aurora on 16 nights; Impossible on 15 nights.

Snowing on 8 days: depth, 6 8 inches; duration of fall, 30.0 hours.

Raining on 6 days; depth, 0.560 inches; duration of fall, 18.6 hours.

Mean of cloudiness=0.62; below the average, 0.13 Most cloudy hour observed 8 a.m.; mean=0.68; least cloudy hour observed, midnight; mean=0.55.

*Sums of the components of the Atmospheric Current, expressed in Miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 2094.43 | 1300.98 | 929.21 | 3413.80 |

Resultant direction, N 72° W; Resultant Velocity, 3.50 miles per hour.

Mean velocity 7.96 miles per hour.

Maximum velocity 46.0 miles, from 9 to 10 a.m. on the 27th.

Most windy day 27th—Mean velocity 20.27 miles per hour. } Difference 19.50 miles.
Least windy day 8th—Mean velocity 0.77 miles per hour. }
Most windy hour, noon to 1 p.m.—Mean velocity, 9.90 miles per hour. } Difference
Least windy hour, 7 to 8 a.m.—Mean velocity, 5.93 miles per hour. } 3.97 miles.

*Great Barometric Movement.*

26th. 10 p.m. = 29.242 } Ascending range = 0.939 in 34 hours.
28th. 8 a.m. = 30.181 }
31st. Midn't = 29.171—Descending range = 1.010 in 88 hours.
Oscillations in 122 hours=1.949 inches.

5th. Dense Fog at 10 p.m.; dark and mild.—7th. Foggy at midnight; very mild day.—9th. Fog from 6 a m. to 6.30 p.m.; very mild.—10th. Rapid descent of temperature from 10 p.m.; very stormy night; foggy from 7 to 8 a.m.—15th. Distinct lunar halo at 9 p.m.—17th. Lunar corona at 6 a.m.; lunar halo 8 p.m. to midnight.—18th. Lunar halo from 9 p.m. to midnight.—21st. Lunar corona at 6 a.m.—26th. Lunar halo at 6 a.m.—27th. Very stormy day; wind in violent squalls; bright meteor in N.W. about 10 p.m.—31st. Solar halo from 9 a.m. to 2 p.m.

The Resultant Direction and Velocity of the Wind for the month of December, from 1848 to 1861 inclusive, were respectively N. 69° W., and 2.97 miles.

### COMPARATIVE TABLE FOR DECEMBER.

| | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Resultant. | | Mean |
| YEAR. | Mean. | Difference from Average. | Maximum observed. | Minimum observed. | Range. | No. of days. | Inches. | No. of days. | Inches. | Direction. | Velocity. | Velocity |
| 1840 | °<br>24.3 | — 1.8 | °<br>41.0 | °<br>— 4.4 | °<br>45.4 | 3 | Inap. | 18 | ... | ... | ... | ... |
| 1841 | 28.7 | + 2.6 | 45.5 | + 2.4 | 43.1 | 7 | 6.600 | 5 | ... | ... | ... | 1.33lbs |
| 1842 | 24.7 | — 1.4 | 40.3 | + 3.8 | 36.5 | 3 | 0.880 | 17 | ... | ... | ... | 0.61 " |
| 1843 | 30.0 | + 3.9 | 41.1 | + 2.7 | 38.4 | 6 | 1.040 | 8 | 8.1 | ... | ... | 0.53 " |
| 1844 | 28.2 | + 2 1 | 48.9 | — 0.8 | 49.7 | 6 | Imp. | 6 | 4.2 | ... | ... | 0.40 " |
| 1845 | 21.1 | — 5.0 | 37.6 | — 2.7 | 40.3 | 2 | Inap. | 12 | 4.7 | ... | ... | 0.70 " |
| 1846 | 27.5 | + 1.4 | 49.2 | + 3.7 | 45.5 | 5 | 1.215 | 9 | 6.0 | ... | ... | 0.57 " |
| 1847 | 30.1 | + 4.0 | 50.0 | + 6.6 | 43.4 | 7 | 1.185 | 8 | 6.8 | ... | ... | 0.35 " |
| 1848 | 29.1 | + 3.0 | 49.1 | + 0.6 | 48.5 | 7 | 2.750 | 7 | 16.5 | S 83 W | 1.12 | 5.44ms. |
| 1849 | 26.5 | + 0.4 | 41.3 | — 5.2 | 46.5 | 5 | 0.840 | 12 | 9.6 | N 82 W | 2.56 | 6.23 " |
| 1850 | 21.7 | — 4.4 | 48.3 | — 9.7 | 58.0 | 2 | 0.190 | 18 | 29.5 | N 44 W | 2.93 | 7.40 " |
| 1851 | 21.5 | — 4.6 | 43.8 | —10.5 | 54.3 | 6 | 1.075 | 15 | 10.7 | N 82 W | 4.00 | 7.37 " |
| 1852 | 31.9 | + 5.8 | 51.0 | +13.9 | 37.1 | 7 | 3.995 | 10 | 20.1 | S 69 W | 1.03 | 6.54 " |
| 1853 | 25.3 | — 0.8 | 42.2 | — 5.2 | 47.4 | 4 | 0.625 | 13 | 22.3 | N 35 W | 2.39 | 4.98 " |
| 1854 | 21.9 | — 4.2 | 41.8 | — 5.9 | 47.7 | 5 | 0.590 | 12 | 17.2 | N 44 W | 4.30 | 8.56 " |
| 1855 | 26.8 | + 0.7 | 45.9 | — 2.1 | 48.0 | 6 | 1.845 | 10 | 29.5 | S 88 W | 5 29 | 11.38 " |
| 1856 | 22.9 | — 3.2 | 41.2 | — 9.1 | 50.3 | 6 | 1.790 | 20 | 16 3 | S 87 W | 4.62 | 11.56 " |
| 1857 | 31.9 | + 5.8 | 45.6 | + 5.7 | 39.9 | 7 | 3.205 | 14 | 9.0 | N 89 W | 2.51 | 6.84 " |
| 1858 | 27.4 | + 1.3 | 43.6 | + 5.0 | 38.6 | 11 | 1.657 | 18 | 10.4 | N 18 W | 1.66 | 9.36 " |
| 1859 | 17.9 | — 8.2 | 54.8 | — 3.3 | 58.1 | 3 | 1.035 | 23 | 37.4 | N 53 W | 4.29 | 10.77 " |
| 1860 | 24.0 | — 2.1 | 38.5 | — 7.0 | 45.5 | 3 | 1.362 | 21 | 13.5 | N 62 W | 4.66 | 10.14 " |
| 1861 | 31.1 | + 5.0 | 55.1 | + 5.7 | 49.4 | 6 | 0.560 | 8 | 6.8 | N 72 W | 3.50 | 7.96 " |
| Mean | 26.11 | ... | 45.26 | —0.72 | 45.98 | 5.3 | 1.515 | 12.9 | 14.66 | ... | ... | 8 18 |
| Diff. from Av'ge. | +5.02 | ... | + 9.84 | +6 42 | +3.42 | + 0.7 | — 0.985 | — 4.9 | — 7.86 | ... | ... | —0 22 |

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST—JANUARY, 1862.

*Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 min. 33 sec. West. Elevation above Lake Ontario, 108 feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resultant Direction. | Velocity of Wind. | | | | | Rain in Inches. | Snow in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | MEAN. | 6 A.M | 2 P.M. | 10 PM | ME'N | | 6 A.M | 2 P.M | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M. | 2 P.M. | 10 P.M. | | 6 A.M | 2 P.M | 10 PM | Re-sul't. | ME'N | | |
| 1 | 29.008 | 29.065 | 29.575 | 29.2485 | ° 41.4 | ° 32.0 | ° 22.6 | ° 30.68 | + ° 5.47 | .232 | .094 | .062 | .135 | .89 | .51 | .52 | .70 | S W | NWbW | NWbW | N ° 70 W | 9.0 | 42.0 | 33.0 | 24.91 | 26.31 | Inp. | 0.1 |
| 2 | .827 | .899 | .991 | .9193 | 16.1 | 18.3 | 6.7 | 12.45 | —12.75 | 068 | .056 | .047 | 054 | .75 | .55 | .77 | .69 | N W | NWbW | N N W | N 31 W | 8.0 | 18.5 | 11.6 | 14.43 | 14.50 | ... | ... |
| 3 | 30.000 | .920 | .839 | .9085 | —0.8 | 7.1 | —0.1 | 2.42 | —22.73 | .037 | .036 | .032 | .036 | .88 | .59 | .72 | .73 | NW bN | N N E | N N E | N 3 E | 14.0 | 6.0 | 8.0 | 8.87 | 9.07 | .. | ... |
| 4 | 29.775 | .774 | .796 | .7883 | 3.1 | 10.7 | 6.0 | 6.25 | —18.88 | .033 | .034 | .043 | .037 | .63 | .48 | .75 | .63 | N b E | N b W | NW bN | N 5 W | 11.7 | 5.0 | 5.5 | 4.09 | 4.30 | ... | ... |
| 5 | .726 | .726 | — | — | 1.0 | 11.8 | — | — | — | .036 | .058 | — | — | .76 | .77 | — | — | N b E | E N E | E b N | N 56 E | 0.5 | 0.8 | 9.0 | 7.18 | 7.52 | ... | 1.0 |
| 6 | .305 | .417 | .606 | .4710 | 15.4 | 20.5 | 18.3 | 17.32 | — 7.82 | .083 | .081 | .087 | .081 | .95 | .73 | .87 | .85 | N E | N b E | NWbW | N 9 E | 15.5 | 2.0 | 4.5 | 3.96 | 4.93 | ... | 0.3 |
| 7 | .756 | .933 | 30.082 | .9405 | 17.9 | 29.3 | 19.4 | 22.60 | — 2.53 | .085 | .115 | .093 | .094 | .87 | .71 | .89 | .78 | W b N | W | W N W | N 75 W | 0.5 | 11.5 | 4.8 | 3.82 | 3 97 | ... | ... |
| 8 | 30.007 | .685 | 29.603 | .7447 | 26.2 | 29.5 | 34.2 | 30.20 | + 5.07 | .110 | .129 | .177 | .144 | .77 | .78 | .89 | .84 | S b E | S b E | S W | S 7 W | 8.0 | 9.0 | 9.0 | 6.43 | 7.77 | ... | 0.5 |
| 9 | 29 605 | .598 | .660 | .6257 | 34.2 | 36.7 | 34.9 | 35.32 | +10.18 | .185 | .163 | .186 | .175 | .93 | .75 | .92 | .85 | SW bW | S W | S S W | S 36 W | 0.2 | 10.0 | 5.0 | 4.18 | 5.07 | 0.005 | ... |
| 10 | .442 | .170 | .585 | .4088 | 36 3 | 42.8 | 25.9 | 34.10 | + 9.05 | . .02 | .232 | .072 | .161 | .94 | .84 | .51 | .76 | S E | W b S | N W | N 68 W | 9.6 | 13.5 | 26.0 | 10.72 | 15.23 | 0.060 | ... |
| 11 | .849 | .661 | .290 | .5830 | 14.0 | 19.7 | 13.6 | 15.85 | — 9.20 | .068 | .090 | .072 | .078 | .83 | .84 | .91 | .87 | N N E | E | E S E | S 85 E | 5.5 | 12.2 | 9.0 | 7.53 | 9.10 | ... | 3.0 |
| 12 | .160 | .084 | — | — | 27.3 | 32.4 | — | — | — | .126 | .153 | — | — | .84 | .83 | — | — | S W | W b S | W b N | N 78 W | 4.0 | 7.5 | 21.7 | 11.85 | 12.40 | 0.050 | 0.2 |
| 13 | .815 | 30.101 | 30.189 | 30.0680 | 3.1 | 7.1 | 1.7 | 4.35 | —20.73 | .044 | .042 | .038 | .042 | .86 | .68 | .80 | .78 | W b N | N | N b W | N 20 W | 23.0 | 8.0 | 4.5 | 7.21 | 8.40 | ... | ... |
| 14 | 30.240 | 30.235 | 30.033 | 30.1513 | 0.3 | 13.6 | 21.2 | 12.00 | —13.10 | .038 | .055 | .085 | .061 | .85 | .67 | .75 | .76 | N W | W | E b S | N 83 E | 8.5 | 1.5 | 13.0 | 6.11 | 9.28 | ... | 4.0 |
| 15 | 29.417 | 29.217 | 29.355 | 29.3293 | 23.3 | 32.7 | 27.3 | 27.60 | + 2.50 | .116 | .165 | .139 | .136 | .93 | .88 | .94 | .90 | E b S | SW bW | W b S | S 64 W | 19.5 | 14.8 | 18.5 | 10.57 | 14.94 | ... | 2.5 |
| 16 | .688 | .957 | 30.105 | .9388 | 18.6 | 19.0 | 8.5 | 14.12 | —10.88 | .083 | .054 | .052 | .059 | .82 | .51 | .79 | .71 | W | W | W N W | S 87 W | 16.0 | 21.0 | 4.5 | 10.38 | 10.65 | ... | ... |
| 17 | 30.041 | .920 | 29.968 | .9737 | 12.9 | 21.2 | 21.9 | 18.78 | — 6.23 | .069 | .099 | .097 | .091 | .89 | .87 | .82 | .87 | NWbW | N E b N | N b E | N 13 E | 1.5 | 5.0 | 4.5 | 4.71 | 5.20 | ... | 1.5 |
| 18 | 29.751 | .634 | .663 | .6803 | 23.0 | 25.5 | 24.4 | 24.43 | — 0.53 | .113 | .118 | .117 | .119 | .92 | .86 | .89 | .91 | N E b E | N E | N E | N 50 E | 8.5 | 4.5 | 3.5 | 6.76 | 6.82 | ... | 3.0 |
| 19 | .508 | .481 | — | — | 20.1 | 25.9 | — | — | — | .105 | .107 | — | — | .97 | .76 | — | — | N E | N E | N E b N | N 42 E | 13.0 | 5.5 | 5.8 | 6.53 | 6.56 | ... | 1.5 |
| 20 | .478 | .504 | .669 | .5662 | 21.5 | 26.2 | 21.2 | 22.37 | — 2.48 | .095 | .110 | .085 | .096 | .82 | .77 | .75 | .80 | N N E | N | N E b N | N 8 E | 9.8 | 9.0 | 2.0 | 7.97 | 8.04 | ... | 0.5 |
| 21 | .754 | .751 | .725 | .7368 | 17.6 | 24.8 | 28.4 | 23.83 | — 0.95 | .088 | .105 | .134 | .110 | .92 | .79 | .86 | .85 | N b E | N E | E b N | N 55 E | 11.0 | 6.2 | 10.0 | 7.50 | 8.23 | ... | 0.5 |
| 22 | .657 | .652 | .715 | .6872 | 26.2 | 32.0 | 29.8 | 28.87 | + 4.10 | .124 | .162 | .146 | .139 | .87 | .89 | .88 | .87 | N E b N | Calm. | W | N 79 W | 6.2 | 0.0 | 7.0 | 2.01 | 2.90 | ... | 0.2 |
| 23 | .734 | .734 | .820 | .7700 | 26.6 | 30.9 | 28.4 | 28.27 | + 3.60 | .134 | .141 | .134 | .133 | .93 | .81 | .86 | .86 | W N W | W N W | Calm. | N 63 E | 0.4 | 0.4 | 0.0 | 0.76 | 2.02 | ... | 0.1 |
| 24 | .788 | .752 | .652 | .7188 | 29.5 | 30.9 | 28.8 | 29.35 | + 4.78 | .144 | .141 | .129 | .136 | .87 | .81 | .81 | .83 | E b N | E b N | E b S | N 84 E | 6.8 | 10.5 | 12.2 | 10.00 | 10.34 | ... | 1.5 |
| 25 | .445 | .250 | .304 | .3307 | 23.0 | 29.1 | 32.0 | 27.80 | + 3.22 | .098 | .148 | .121 | .122 | .79 | .94 | .66 | .81 | N E b E | S | W | S 86 W | 10.4 | 0.5 | 22.0 | 4.67 | 10.07 | ... | 5.0 |
| 26 | .485 | .693 | — | — | 23.3 | 24.4 | — | — | — | .089 | .075 | — | — | .71 | .57 | — | — | W | W b N | W N W | N 84 W | 24.0 | 25.5 | 2.9 | 12.98 | 13.01 | ... | ... |
| 27 | 30.090 | 30.127 | 30.169 | 30.1358 | 7.5 | 26 2 | 17.2 | 16.37 | — 7.98 | .054 | .124 | .081 | .081 | .88 | .87 | .84 | .85 | W | Calm. | N b E | N 66 E | 1.4 | 0.0 | 2.0 | 2.46 | 3.46 | ... | ... |
| 28 | 30.047 | 29.772 | 29.519 | 29.7480 | 21.9 | 20.5 | 28.0 | 24.00 | — 0.30 | .105 | .093 | .139 | .119 | .89 | .85 | .90 | .91 | E | E b S | E S E | S 84 E | 14.8 | 18.8 | 9.5 | 14.09 | 14.17 | Inp. | 2.0 |
| 29 | 29.361 | .468 | 622 | .5027 | 29.1 | 36.0 | 33.8 | 32.23 | + 8.03 | .155 | .181 | .129 | .154 | .96 | .85 | .66 | .84 | E b S | SW bW | N W | N 57 W | 2.4 | 3.5 | 13.5 | 3.31 | 3.98 | ... | ... |
| 30 | .654 | .706 | .858 | .7567 | 21.9 | 28.6 | 20.1 | 23.38 | — 0.72 | .084 | .110 | .091 | .096 | .71 | .70 | .85 | .76 | NWb N | W N W | NW bN | N 5 W | 7.0 | 8.0 | 12.6 | 5.56 | 7.65 | ... | Inp. |
| 31 | 30.020 | .966 | .740 | .9072 | 10.0 | 24.4 | 27.0 | 21.30 | — 2.68 | .059 | .103 | .129 | .097 | .87 | .78 | .88 | .82 | N E b N | E b S | E S E | S 76 E | 1.8 | 6.5 | 13.0 | 7.28 | 7.78 | ... | ... |
| M | 29.7242 | 29.6988 | 29.7457 | 29.7274 | 19.25 | 25.01 | 21.53 | 21.71 | — 3.09 | .100 | .110 | .101 | .103 | .86 | .75 | .80 | .81 | ........... | ........... | ........... | ........... | 8.79 | 9.26 | 9.94 | ...... | 8.83 | 0.115 | 27.4 |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JANUARY, 1861.

Highest Barometer........................ 30.300 at 10 a. m. on 14th } Monthly range =
Lowest Barometer ........................ 28.965 at 8 a. m. on 1st } 1.335 inches.

Self-regist'ing Thermom.
Maximum Temperature ............... 44°5 on a.m. of 1st } Monthly range=
Minimum Temperature ............... —2°6 on a.m. of 3rd } 47°1
Mean maximum Temperature ..................... 27°58 } Mean daily range=
Mean minimum Temperature ..................... 15°03 } 12°55
Greatest daily range ............ 25°8 from a. m. of 14th to a. m. of 15th.
Least daily range.................. 2°8 from a. m. to p. m. of 26th.

Warmest day......... 9th .. Mean temperature......... 35°32 } Difference = 32°90.
Coldest day......... .. 3rd... Mean temperature......... 2°42 }
Maximum { Solar................................. 52°2 on p. m. of 23rd } Monthly range =
Radiation. { Terrestrial............—10°0 on a. m. of 5th and 13th } 62°2

Aurora observed on 4 nights, viz.: 1st, 2nd, 6th, and 29th.
Possible to see Aurora on 11 nights; impossible on 20 nights.
Snowing on 19 days, depth 27.4 inches; duration of fall, 88.9 hours.
Raining on 5 days,—depth 0.115 inches; duration of fall 7.2 hours.
Mean of cloudiness = 0.73. Above average 0.02.
Most cloudy hour observed, 4 p. m., mean = 0.82; least cloudy hour observed 10 p.m.; mean, = 0.62.

*Sums of the components of the Atmospheric Current, expressed in miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 2485.49 | 685.77 | 2047.01 | 2918.18 |

Resultant direction N. 26° W.; Resultant velocity 2.69 miles per hour.
Mean velocity............................ 8.83 miles per hour.
Maximum velocity .................... 43.3 miles, from 5 to 6 p. m. on 1st.
Most windy day ...... 1st............Mean velocity, 26.31 miles per hour. } Difference=
Least windy day ......23rd............Mean velocity, 2.02 ditto. } 8.86 miles.
Most windy hour ...... 9 to 10 p.m..........Mean velocity, 10.06 ditto. } Difference=
Least windy hour ...... 2 to 3 a.m. .........Mean velocity 7.34 ditto. } 2.72 miles.

*Great Barometric Movement.*

12th. 2 p.m. = 29.084 }
14th. 10 a.m.= 30.300 } Ascent in 44 hours = 1.216
15th. 4 p.m. = 29.216—Descent in 30 hours = 1.084
Movement in 74 hours = 2.300 inches.

1st. Stormy day. Wind very high and squally. Rapid descent of temperature from a.m. of 1st to a.m. of 2nd = 30°6.—2nd. Bright meteor in N.E. at 5.49 a.m.—10th. Rapid descent of temperature from p.m. of 10th to a.m. of 11th = 30°2. Dense Fog 8 a.m. to noon.—12th. Rapid descent of temperature from p.m. of 12th to a.m. of 13th = 30°9.—13th. Imperfect Lunar Halo from 6 p.m.—14th. Imperfect Solar Halo at 4 p.m. Perfect Lunar Halo from 6 to 11.40 p.m.—16th. Lunar Corona 6 p.m. Perfect Lunar Halo from 10.15 p.m.—25th. Snowing and drifting heavily till 7.40 p.m. Wind squally. 27th. Imperfect Solar Halo at 2 p.m. Foggy at 7 p.m.

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### COMPARATIVE TABLE FOR JANUARY.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | Diff. above aver'ge (23°5) | Max. ob-served. | Min. ob-served. | Range. | No. of days. | Inches | No. of days. | Inches | Resultant Direction. | Resultant V'y. | Mean Force or Velocity. |
| 1840 | 17.0° | — 6.5° | 40.6° | —13.8° | 54.4° | 4 | 1.395 | 11 | ... | ... | ... | ............ |
| 1841 | 25.6 | + 2.1 | 41.7 | — 4.1 | 45.8 | 2 | 2.150 | 14 | ... | ... | ... | 0.36 lbs. |
| 1842 | 27.9 | + 4.4 | 45.8 | 1.3 | 44.5 | 5 | 2.170 | 9 | ... | ... | ... | 0.78 |
| 1843 | 28.7 | + 5.2 | 54.4 | 1.5 | 52.9 | 6 | 4.295 | 12 | 14.2 | ... | ... | 0.69 |
| 1844 | 20.2 | — 3.3 | 44.6 | — 7.7 | 52.3 | 7 | 3.005 | 11 | 24.9 | ... | ... | 0.70 |
| 1845 | 26.5 | + 3.0 | 43.0 | — 3.4 | 46.4 | 5 | Imp. | 9 | 22.7 | ... | ... | 0.70 |
| 1846 | 26.7 | + 3.2 | 41.2 | 0.3 | 40.9 | 5 | 2.335 | 10 | 6.0 | ... | ... | 0.55 |
| 1847 | 23.3 | — 0.2 | 42.6 | — 2.2 | 44.8 | 7 | 2.135 | 5 | 7.5 | ... | ... | 1.09 |
| 1848 | 28.7 | + 5.2 | 51.5 | —12.0 | 63.5 | 7 | 2.245 | 8 | 7.1 | N 82° W | 2.03 | 5.82mls. |
| 1849 | 18.5 | — 5.0 | 40.1 | —15.2 | 55.3 | 4 | 1.175 | 10 | 9.2 | N 63° W | 3.06 | 6.71 |
| 1850 | 29.7 | + 6.2 | 46.3 | 10.6 | 35.7 | 5 | 1.250 | 8 | 5.2 | N 37° W | 0.69 | 5.80 |
| 1851 | 25.5 | + 2.0 | 43.2 | —12.8 | 56.0 | 4 | 1.275 | 10 | 7.8 | S 77° W | 3.26 | 7.69 |
| 1852 | 18.4 | — 5.1 | 37.3 | — 7.0 | 44.3 | 0 | 0.000 | 19 | 30.9 | N 68° W | 3.14 | 7.67 |
| 1853 | 23.0 | — 0.5 | 40.9 | — 6.6 | 47.5 | 1 | 0.290 | 6 | 7.5 | N 27° W | 2.52 | 6.34 |
| 1854 | 23.6 | + 0.1 | 45.2 | — 4.3 | 49.5 | 7 | 1.270 | 11 | 7.5 | N 77° W | 2.44 | 6.91 |
| 1855 | 25.9 | + 2.4 | 48.2 | — 4.7 | 52.9 | 5 | 0 525 | 13 | 23.3 | N 73° W | 1.91 | 7.26 |
| 1856 | 16.0 | — 7.5 | 33.1 | —12.1 | 45.2 | 0 | 0.000 | 14 | 13.6 | N 75° W | 5.24 | 10.69 |
| 1857 | 12.8 | —10.7 | 34.6 | —20.1 | 54.7 | 3 | Inap | 16 | 21.8 | N 70° W | 4.96 | 10.31 |
| 1858 | 30.0 | + 6.5 | 45.8 | 7.5 | 38.3 | 6 | 1.152 | 11 | 4.0 | N 71° W | 2.33 | 7.40 |
| 1859 | 26.4 | + 2.9 | 41.5 | —26.5 | 68.0 | 6 | 1.449 | 19 | 16.4 | S 81° W | 3.17 | 8.76 |
| 1860 | 23.4 | — 0.1 | 45.4 | — 5.1 | 50.5 | 6 | 0.740 | 16 | 8.7 | N 89° W | 6.09 | 9.37 |
| 1861 | 19.9 | — 3.7 | 34.5 | — 7.0 | 41.5 | 4 | 0.685 | 23 | 20.6 | N 86° W | 2.92 | 9.30 |
| 1862 | 21.7 | — 1.8 | 42.8 | — 1.9 | 44.7 | 5 | 0.115 | 19 | 27.4 | N 26° W | 2.69 | 8.83 |
| Results to 1861. | 23.53 | ... | 42.80 | —6.52 | 49.31 | 4.5 | 1.407 | 12.0 | 13.63 | N 77° W | 2.98 | 7.86 |
| Diff. for 1862. | — 1.82 | ... | ... | +4.62 | — 4.61 | + 0.5 | — 1.292 | + 7.0 | + 13.77 | ......... | ...... | + 0.97 |

## MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—DECEMBER, 1861.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M.D., LL.D.

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. t'nths | Rain in inches. | Snow in inches. | Weather, &c. A Cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 PM | 6 A.M. | 2 P.M. | 10 P.M | | | | | 6 A M. | 2 P.M. | 10 P.M. |
| 1 | 29.774 | 29.670 | 29.514 | 16.4 | 28.1 | 25.4 | .068 | .120 | .117 | .75 | .80 | .87 | s s E | N E b E | N E b E | 122.60 | 4.0 | ... | 1.60 | Slight Snow. | Snow. | Snow. |
| 2 | 561 | 617 | 719 | 19.6 | 26.2 | 16.5 | 093 | 105 | 068 | 92 | 75 | 75 | w s w | W s W | w s W | 338.50 | 3.0 | ... | 0.57 | Cu. Str. 8. | C. C. Str. 10. | Clear. |
| 3 | 784 | 862 | 30.147 | 7.6 | 22.2 | 8.3 | 054 | 084 | 050 | 88 | 71 | 82 | w s w | w | s w b W | 151.30 | 3.0 | ... | ... | C. C. Str. 10. | Clear. | Do. |
| 4 | 933 | 962 | 29.874 | — 3.2 | 24.0 | 24.2 | 030 | 083 | 100 | 80 | 66 | 80 | W s w | s w b s | s b w | 27.30 | 2.5 | ... | ... | Clear. | C. C. Str. 4. | Cu. Str. 10. |
| 5 | 952 | 30.147 | 30.030 | 20.0 | 34.0 | 29.2 | 091 | 162 | 140 | 85 | 84 | 86 | W b s | w | s | 16.20 | 3.5 | ... | ... | Cu. Str. 10. | Cirr. Str. 10. | Do. 10. |
| 6 | 30.329 | 244 | 250 | 21.2 | 31.6 | 32.0 | 096 | 149 | 162 | 85 | 84 | 89 | N E b E | N E b E | E S E | 151 70 | 4.0 | Inap. | ... | Do. 10. | Do. 10. | Do. 10. |
| 7 | 039 | 29.947 | 29.824 | 36.2 | 39.2 | 39.0 | 191 | 216 | 223 | 90 | 91 | 98 | s b w | s S E | s | 18.50 | 3.5 | ... | ... | Cirr. Str. 4. | Do. 10. | Rain. |
| 8 | 29.681 | 754 | 815 | 39.1 | 46.9 | 37.8 | 220 | 262 | 211 | 92 | 84 | 94 | s w | W s W | N | 71.70 | 5.5 | 0.600 | ... | Fog. | Hazy. | Cu. Str. 10. |
| 9 | 891 | 900 | 857 | 34.6 | 39.0 | 25.2 | 169 | 195 | 182 | 84 | 82 | 89 | E | s w | s E b E | 23.20 | 5.5 | ... | ... | Cu. Str. 10. | Cu. Str. 10. | Do. 10. |
| 10 | 800 | 744 | 594 | 34.0 | 36.0 | 36.1 | 182 | 177 | 191 | 95 | 85 | 90 | N E b N | N E b E | s w | 121.40 | 3.5 | 0.126 | ... | Do. 10. | Do. 10. | C. C. Str. 8. |
| 11 | 747 | 30.000 | 30.259 | 34.2 | 33.0 | 15.0 | 175 | 079 | 061 | 89 | 65 | 76 | N b w | W N W | N W | 651.90 | 5.0 | 0.380 | ... | Rain. | Clear. | Clear. |
| 12 | 30.341 | 331 | 372 | 15.2 | 26.0 | 19.1 | 069 | 128 | 071 | 71 | 87 | 69 | s b E | s s w | s | 60.10 | 3.0 | ... | Inap. | Cu. Str. 10. | Cu. Str. 10. | Clear. |
| 13 | 149 | 137 | 101 | 28.9 | 37.3 | 31.1 | 123 | 192 | 155 | 77 | 88 | 89 | s s w | w s w | s s w | 47.00 | 4.0 | ... | ... | Do. 4. | Do. 10. | Cir. Str. L. H. |
| 14 | 29.870 | 29.746 | 29.749 | 27.1 | 42.2 | 37.6 | 129 | 199 | 171 | 88 | 74 | 76 | s s W | w s w | w | 119.20 | 2.0 | ... | ... | C. C. Str. 8. | Cu Str. 4. | Cl'r. I. h. A.B. |
| 15 | 30.137 | 30.101 | 30.051 | 16.4 | 26.0 | 25.6 | 074 | 111 | 111 | 83 | 81 | 81 | N w | N b w | w | 473.20 | 2.5 | ... | ... | Cirr. Str. 4. | Clear. [H. | C. C. Str. 10. |
| 16 | 29.600 | 29.714 | 29.820 | 24.1 | 30.1 | 29.1 | 110 | 130 | 129 | 86 | 78 | 82 | s W | W | N N E | 224.40 | 2.5 | ... | ... | Cu. Str. 10. | C. C. Str. 6. S. | Clear. |
| 17 | 30.191 | 30.100 | 847 | 10.7 | 25.7 | 26.0 | 048 | 110 | 123 | 69 | 80 | 87 | s E b E | s W b s | E b s | 74.70 | 3.5 | ... | ... | Clear. | C. C. 4. Ip. H. | Cirr. 4. and H. |
| 18 | 29.654 | 29.863 | 30.114 | 30.0 | 33.0 | 15.1 | 136 | 150 | 161 | 83 | 80 | 73 | s w b w | N b W | N E b E | 221.50 | 3.0 | ... | ... | Cu. Str. 10. | Clear. | Clear. |
| 19 | 987 | 684 | 29 611 | 9.0 | 19.8 | 26.3 | 051 | 081 | 118 | 77 | 77 | 83 | E s E | N E b E | s s E | 49.70 | 3.5 | ... | Inap. | Do. 10. | Snow. | Sleet. |
| 20 | 667 | 914 | 30.054 | 20.0 | 10.0 | 0.0 | 191 | 089 | 052 | 85 | 57 | 70 | W b N | w N w | w | 247.20 | 4.8 | ... | ... | Do. 4. | Cu. Str. 4. | Cl'r. Ft. A. B. |
| 21 | 30.199 | 30.224 | 269 | —10.0 | 4.1 | 8.1 | 022 | 041 | 051 | 78 | 74 | 77 | W | s w | s s W | 845.89 | 2.0 | ... | ... | Clear. | Clear. | Cu. Str. 8. |
| 22 | 257 | 162 | 114 | 12.0 | 28.0 | 21.0 | 051 | 123 | 096 | 70 | 81 | 95 | s s W | s s w | E S E | 85.80 | 3.0 | ... | ... | Str. 2. | Cu. Str. 9. | Do. 4. |
| 23 | 29.714 | 29.437 | 29.378 | 17.0 | 20.9 | 23.0 | 078 | 091 | 112 | 83 | 85 | 93 | N E b E | N E b E | N E b E | 240.50 | 5.5 | ... | 2.50 | Snow. | Snow. | Snow. |
| 24 | 514 | 669 | 868 | 14.1 | 16.6 | 0.5 | 070 | 053 | 036 | 82 | 58 | 84 | w | w b s | w b s | 563.70 | 4.5 | ... | ... | Cu. Str. 10. | Cu. Str. 10. | Cu. Str. 10. |
| 25 | 30.026 | 30.079 | 30.220 | — 7.3 | 10.0 | 0.6 | 020 | 045 | 036 | 64 | 68 | 84 | w b s | w s w | s s E | 69.90 | 2.0 | ... | ... | Clear. | Do. 4. [F. H. | Clear. |
| 26 | 220 | 045 | 000 | — 9.1 | 11.0 | 26.3 | 024 | 042 | 123 | 79 | 59 | 87 | N E b E | N E b E | s b E | 55.80 | 4.0 | ... | ... | C. C. Str. 4. | C. C. Str. 10. | Sleet. |
| 27 | 29.502 | 29.560 | 29.984 | 34.0 | 25.0 | 9.1 | 175 | 100 | 051 | 74 | 77 | 83 | s s w | w | w | 582.10 | 4.5 | 0.210 | ... | Rain. | Do. 10. | Cu. Str. 10. |
| 28 | 30.277 | 30.179 | 30.210 | — 4.0 | 9.0 | 1.0 | 031 | 051 | 038 | 83 | 77 | 85 | w s w | W s W | s w b w | 420.90 | 2.0 | ... | ... | Clear. | Clear. | Clear. |
| 29 | 181 | 29.924 | 29.944 | — 1.0 | 15.1 | 10.0 | 028 | 046 | 084 | 68 | 55 | 78 | s E | E b s | s b w | 17.40 | 2.0 | ... | ... | C. C. Str 8. | Cu. Str. 8. | Cu. Str. 10. |
| 30 | 29.736 | 953 | 30.054 | 8.1 | 22.2 | 5.0 | 048 | 084 | 041 | 77 | 71 | 74 | W s w | w | s s W | 162.60 | 2.0 | ... | 0.50 | Cu. Str. 10. | Do. 10. | Do. 10. |
| 31 | 894 | 737 | 29.891 | 8.1 | 21.0 | 14.1 | 048 | 080 | 067 | 77 | 71 | 81 | s b E | s E | N N E | 6.10 | 4.0 | ... | 3.10 | Do. 10. | Snow. | Snow. |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—JANUARY, 1861.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D., LL.D.

*Latitude*—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. (tenths) | Rain in Inches. | Snow in Inches. | WEATHER, &c. A cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | | | | | 6 A.M. | 2 P.M. | 10 P.M. |
| 1 | 29.482 | 28.863 | 29.268 | 19.1 | 26.0 | 10.0 | .087 | .123 | .045 | .84 | .87 | .68 | N E b E | N w b w | w | 230.80 | 4 0 | In'p. | 1.79 | Snow. | Rain. | Cirr. Str. 10. |
| 2 | 747 | 29.799 | 941 | — 6.5 | 6.1 | — 1.6 | .026 | .035 | .034 | .80 | .61 | .84 | w b N | w N w | w N w | 184.80 | 3.0 | ... | ... | Clear. | Clear. | Cl'r. Ft. Au.B. |
| 3 | 998 | 985 | 997 | —11.4 | 2.3 | — 7.0 | .014 | .034 | .022 | .53 | .71 | .69 | w N w | w b N | w b N | 136.80 | 2.0 | ... | ... | Do. | Do. | Do. |
| 4 | 903 | 840 | 918 | —16.1 | — 1.0 | — 6.6 | .019 | .028 | .026 | .43 | .68 | .80 | w b N | w b N | w b N | 111.80 | 2.0 | ... | ... | Do. | Do. | Do. |
| 5 | 953 | 917 | 917 | —11.5 | 3.0 | — 2.9 | .020 | .042 | .032 | .76 | .86 | .83 | w b s | w b N | w s w | 95.30 | 2.0 | ... | ... | Do. | Do. | Do |
| 6 | 765 | 779 | 784 | —10.5 | 4.7 | 3.7 | .021 | .014 | .046 | .77 | .84 | .87 | N E b E | N E b E | s s E | 0.00 | 3.0 | ... | ... | Cu. Str. 6. | Cu. Str. 4. | Cu. Str. 8. |
| 7 | 870 | 931 | 30.186 | 8.0 | 24.0 | 7.0 | .048 | .100 | .048 | .77 | .79 | .77 | w b s | w | w | 1.00 | 4.0 | ... | 0 75 | Snow. | Clear. | Clear. |
| 8 | 30.317 | 30.101 | 29.821 | — 8.0 | 22.2 | 24.4 | .020 | .084 | .111 | .66 | .71 | .86 | w | s s E | s s w | 37.00 | 4 5 | ... | ... | Hoar Frost. | Cu Str. 10. | Cu. Str. 10. |
| 9 | 29.804 | 29.797 | 811 | 30.0 | 37.0 | 36.0 | .148 | .184 | .177 | 89 | .85 | .85 | s s w | w b s | w b s | 83.10 | 3.0 | ... | 0.75 | Cu. Str. 10. | Do. | Do. 10. |
| 10 | 752 | 450 | 319 | 19.2 | 21.1 | 36.2 | .087 | .096 | .191 | .84 | .85 | .90 | E b s | N E b E | w | 177.90 | 3.5 | In'p. | ... | Do. 10. | Rain. | Do. 10. |
| 11 | 30.088 | 30.028 | 30.007 | — 9.4 | 1.3 | — 3.6 | .022 | .036 | 031 | .76 | .72 | .83 | w b N | N E | N E b E | 147.30 | 2.0 | ... | ... | Clear. | C. C. Str. 4. | C. C. Str. 8. |
| 12 | 29.510 | 29.328 | 29.376 | — 1.0 | 14.2 | 18.4 | .034 | .065 | .093 | .84 | .79 | .92 | N E b E | N E b E | s w | 139.20 | 4.0 | In'p. | 3.90 | Snow. | Snow. | Cu. Str. 10. |
| 13 | 925 | 30.188 | 30.410 | — 1.0 | — 1.2 | —10.3 | .036 | .028 | .015 | .84 | .68 | .55 | w N w | N w b w | w | 429.60 | 3.0 | ... | ... | Clear. | Clear. | Clear. Au. B. |
| 14 | 30.561 | 565 | 568 | —27.7 | 0.0 | — 5.0 | .009 | .026 | .025 | .89 | .56 | .80 | N E b E | N E b E | N E b E | 3.90 | 3.0 | ... | ... | Do. | Do. | C.C.Str.6.L.H. |
| 15 | 651 | 29.774 | 29.510 | — 2.0 | 15.4 | 17.0 | .030 | .065 | .073 | .80 | .74 | .83 | N E b E | N E b E | N E b E | 202.80 | 4.5 | ’ | 7.15 | Snow. | Snow. | Cu. Str. 10. |
| 16 | 29.698 | 749 | 30.025 | 19.0 | 17.4 | — 0.6 | .082 | .072 | .036 | .84 | .75 | .84 | w | w | w | 223.80 | 4.5 | ... | ... | Cu. Str. 4. | Cu. Str. 4. | Clear. |
| 17 | 30.367 | 30.278 | 296 | — 2.0 | 17.4 | 12.3 | .034 | .072 | .060 | .84 | .75 | .80 | s s w | s | s b w | 0.00 | 3 5 | ... | In'p | Do. 10. | Do. 4. | C. Cum. 4. |
| 18 | 228 | 054 | 036 | 15.1 | 21.2 | 16.1 | .070 | .093 | .074 | .81 | .80 | .83 | s s E | N E b E | N E b E | 13.10 | 5.0 | ... | 6.14 | Do. 10. | Snow. | Cu. Str. 10. |
| 19 | 29.995 | 29.884 | 29.927 | 3.0 | 20.1 | 19.2 | .041 | .081 | .087 | .74 | .77 | .84 | N E b E | N E b E | N E b E | 205.40 | 5.5 | ... | 1.01 | Do. 10. | Cu. Str. 10. | Do. 10. |
| 20 | 894 | 851 | 967 | 17.1 | 20.1 | 19.1 | .098 | .091 | .091 | .83 | .85 | .85 | N E b E | N E b E | N E b E | 366.10 | 5.5 | ... | 7.00 | Snow. | Snow. | Snow. |
| 21 | 30.119 | 30.176 | 30.097 | 15.4 | 13.0 | 10.1 | .070 | .063 | .054 | .80 | .81 | .78 | N E b E | N E b E | N E b E | 194.20 | 1.5 | ... | ... | Clear. | Clear. | Clear. |
| 22 | 089 | 151 | 114 | 8.4 | 18.1 | 17.1 | .018 | .082 | .078 | .77 | .84 | .83 | N E b E | N E b E | N E b E | 48.40 | 3.0 | ... | 0.75 | C. C. Str. 10. | Snow. | Snow. |
| 23 | 094 | 052 | 139 | 17.4 | 33.6 | 25.0 | .074 | .143 | .117 | .80 | .79 | .87 | s s w | s s w | N E b N | 1.00 | 2.5 | ... | ... | Cu. Str. 10. | C. C. Str. 4. | Cu. Str. 10. |
| 24 | 241 | 019 | 174 | 8.4 | 22.1 | 10.6 | .048 | .084 | .048 | .77 | .71 | .69 | s s E | N E b E | N E b E | 0.00 | 1.5 | ... | ... | Hazy. | Clear. | Do. 4. Ft. A.B. |
| 25 | 29.946 | 29.741 | 29.618 | 14.1 | 24.1 | 18.2 | .067 | .111 | .082 | .81 | .86 | .84 | N E b E | N E b E | N E b E | 91.40 | 3.0 | ... | 6.14 | Cu. Str. 10. | Snow. | Snow. |
| 26 | 571 | 647 | 867 | 20.0 | 25.2 | 17.2 | .091 | .117 | .068 | .85 | .86 | .75 | w b s | w N w | w | 223.40 | 3.5 | ... | I.47 | Snow. | Cu Str. 4. | Clear. |
| 27 | 30.184 | 30.314 | 30.666 | 12.1 | 12.8 | 0.6 | .060 | .054 | .038 | .80 | .71 | .85 | w N w | w N w | w N w | 476.44 | 1.0 | ... | ... | Cu. Str. 4. | Clear. | Do. |
| 28 | 414 | 274 | 253 | —15.5 | 12.1 | 0.0 | .014 | .045 | .032 | .70 | .60 | .70 | w b N | w | w | 100.80 | 1 0 | ... | ... | Hoar Frost. | Do. | Cu. Str. 10. |
| 29 | 29.886 | 29.814 | 29.874 | 3.0 | 17.1 | 16.0 | .036 | .078 | .074 | .72 | .83 | .85 | N E b E | N w b w | w N w | 133.70 | 1.8 | ... | In'p | Snow. | Sleet. | Do. 10. |
| 30 | 954 | 967 | 30.050 | 16.1 | 32.1 | 23.2 | .074 | .143 | .089 | .85 | .79 | .72 | s s w | w s w | w N w | 1.30 | 1.5 | ... | ... | Cu. Str. 10. | Clear. | Do. 10. |
| 31 | 30.315 | 30.331 | 345 | 2.0 | 16.1 | 1.0 | .032 | .059 | .032 | .70 | .65 | .70 | w N w | w N w | w N w | 39.60 | 1.5 | ... | ... | Clear. | Do | Cl'r.Zo.li't br't |

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR DECEMBER, 1861.

| | | |
|---|---|---|
| Barometer | Highest, the 12th day | 30.372 |
| | Lowest, the 23rd day | 29.378 |
| | Monthly Mean | 29.892 |
| | Monthly Range | 0.994 |
| Thermometer | Highest, the 8th day | 46°9 |
| | Lowest, the 21st day | -10°0 |
| | Monthly Mean | 20°54 |
| | Monthly Range | 56°9 |
| Greatest intensity of the Sun's rays | | 69°8 |
| Lowest point of Terrestrial Radiation | | -11°7 |
| Mean of Humidity | | .796 |

Rain fell on 5 days, amounting to 1.306 inches; it was raining 31 hours, and was accompanied by Thunder on 1 day.

Snow fell on 7 days, amounting to 8.27 inches; it was snowing 80 hours and 55 minutes.

Most prevalent wind, W. S. W.

Least prevalent wind, N.

Most windy day, the 11th day; mean miles per hour, 27.18.

Least windy day, the 31st day; mean miles per hour, 0.25.

Aurora Borealis visible on 3 nights.

Solar Halo visible on 3 days.

Lunar Halo visible on 3 nights.

The Electrical state of the Atmosphere has indicated high intensity.

Winter fairly set in on the 23rd day.

Encke's comet visible.

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR JANUARY, 1861.

| | | |
|---|---|---|
| Barometer | Highest, the 27th day | 30.666 |
| | Lowest, the 1st day | 28.863 |
| | Monthly Mean | 29.845 |
| | Monthly Range | 1.803 |
| Thermometer | Highest, the 9th day | 37°.0 |
| | Lowest, the 14th day | -27°.7 |
| | Monthly Mean | 9°.48 |
| | Monthly Range | 64°.7 |
| Greatest intensity of the Sun's Rays | | 45°.1 |
| Lowest Point of Terrestrial Radiation | | -29°.2 |
| Mean of Humidity | | .783 |

Rain fell on 4 days, inappreciable.

Snow fell on 13 days amounting to 36.85 inches. It was snowing 95 hours and 28 minutes.

Most prevalent wind, the N. E. by E.

Least prevalent wind, the S.

Most windy day, the 27th; mean miles per hour, 19.85.

Least windy day, the 17th; Calm.

Aurora Borealis visible on 3 nights.

Lunar Halo very bright on 1 night.

Zodiacal light bright (but Venus presents an early and well defined view.)

The Electrical state of the Atmosphere has indicated high intensity.

*Postscript.*—Mr. Chapman wishes to announce, for the information of correspondents and others, that, with the issue of the present Number, his connexion with the *Canadian Journal* as General Editor, is brought to a close. A projected visit to Europe, combined with the pressure of other work, has compelled him to place his resignation in the hands of the Editing Committee. He is happy to add, however, that the *Journal* will be carried on, at least for the present, under the able management of Professor Hincks of University College, Toronto.

*March*, 1862.

T. D. Harrel Esqr

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THE

# CANADIAN JOURNAL

OF

# INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES. No. XXXIX.

MAY, 1862.

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THE CANADIAN JOURNAL.

No. XXXIX.—MAY, 1862.

NEW SERIES.

# NOTES ON ANCHOR ICE.

BY T. C. KEEFER, ESQ.
CIVIL ENGINEER.

*Read before the Canadian Institute, February 1st,* 1862.

Those who visit Montreal for the first time during the season of navigation, will be struck with the absence of warehouses upon or near the wharves; and—unless previously informed of the fact—will be surprised to learn that those wharves, at which transatlantic vessels are loading and discharging, are, for four months in the year, invisible,—being submerged from the middle of December until the middle of April:—that the Sault Normand, opposite the city, is obliterated, and that, over the track of that swift current which can now only be stemmed by the most powerful steamers, winter roads for the heaviest description of traffic are regularly *balizéed* out, and maintained, for one-third or one-fourth of the year.

The average winter level of the St. Lawrence, opposite Montreal, is about fifteen feet above the summer one, but the extreme range from the lowest summer level has, at the taking or departure of the ice, sometimes attained a maximum of twenty-five feet.

A full and graphic description of the causes which bring about this winter elevation of a mighty river, where it is beyond the tidal influence, and while its volume is daily diminishing, will be found in a paper "On the Packing of Ice in the River St. Lawrence," by Sir William Logan, published in the Transactions of the Geological Society of London for 1842.

*This* rise of the river—at least so far as to secure the formation of a winter road in front of the city—has always been viewed with satisfaction rather than alarm, and is confined to the section *below* the Lachine Rapids. Above the Rapids the level is uninfluenced by the annual icepacks below it; and as the current is very strong,—the fall between Lake St. Louis and the head of the rapids being about three feet per mile average—the river is open throughout the winter, and is navigated by a steam ferry-boat between Lachine and Caughnawaga. But, in the latter part of January, 1857, after a cold "term" of unexampled severity and duration—long after the ice had taken opposite the city, and when, according to all previous experience, no farther rise was to be apprehended, either above or below the rapids, until the "break up" in the spring—the River, above the Lachine Rapids (where it is always unfrozen,) rose suddenly four to five feet, pouring an Arctic current down the aqueduct of the new Water Works. A few feet more of elevation would have sent the river over its banks, and the consequences might have been most serious.

Such intense cold was followed, as is usual, by a rapid rise of temperature, whereupon the water fell about two feet, but thereafter remained for weeks at least two feet above its ordinary level.

There is a tradition of something similar having occurred about seventy years ago, but this was not heard of until after the irruption; all recent experience and inquiry going to shew that after the ice has taken, the water in this reach lowers gradually with slight fluctuations until the spring.

This flashing above the rapids was independent of any movement of the fixed ice below, either opposite Montreal or in the Laprarie Basin, the levels of which remained undisturbed. Another peculiarity was—the absence of any visible cause; no ice had descended or was descending, and on the surface nothing but blue water was to be seen. The continuous descent, for days and weeks before the river is frozen over above the city, of large masses of ice which being arrested below would dam back the water, is sufficient to account for the rise at Montreal; but in this case there was no descending ice, the Lake St. Louis being frozen over just above Lachine, and the narrow bordages, in the intervening distance of about four miles to the rapids, remaining *in situ*. What then caused this mysterious and alarming elevation of the river in the dead of winter when there had been no rain or thaw, and while all its tributaries were sealed by intense frost?

The St. Lawrence was undoubtedly raised in its bed by the deposition of "anchor" or "ground" ice upon its rocky and stony bottom.

While the weather continues cold, no matter how intense that cold may be, nothing but a surface of clear water is visible in that stretch of rapid river between the Lachine Rapids and Lake St. Louis; but upon the first mild day after very cold weather, the whole surface of this open water is covered with white-capped cakes and floes of "sludge" or "brash" ice, which continue to descend for a day or two, when all is clear again. By watching the river closely, changes will be observed in the number and form of the ice-cakes in any given area: this is caused by new accessions which rise above the surface with a slight spring, a dark-coloured mass like snow saturated with water, but which rolling round and settling back speedily assume a snow-white cap—by the drainage of those parts above the water level.

This spongy ice which has thus left its anchorage is carried down the river and stowed away under the field ice,—upon the shoals and in every nook and crevice where the current is weak,—and is also tucked by the eddies under the bordages until it rests upon the bottom.

Anchor ice is formed only in open-running water. It never forms where the surface is covered with stationary ice, although it is often found in banks under the solid ice below rapids or currents of open water. In consequence of the difficulty and danger of sounding in such situations, and in such severe weather, the limit to the depth of water under which it will form is not easily ascertained: but there is no reason to doubt that it forms upon the whole bed of the St. Lawrence, wherever there is open water.

It does not appear that great or continued cold is necessary to its formation in all situations, as it has been found in brooks immediately after the first frost and before lake ice has become safe for travel: it is also one of the earliest formations upon those portions of shoals and rapids barely covered with water. But in the deeper water above the head of rapids its abundant formation (as indicated by its rising and covering the surface) occurs only after several days of a temperature considerably below zero.

It also appears that anchor ice does not melt as readily as solid ice, because it is found in banks under the field ice, during the whole winter, even after the current has cut through the surface ice; and in the rapids where it has grown above the surface of the water, or encroached upon the sides of the channel so as to dam back and raise the water, it appears to yield upon the advent of milder weather chiefly by losing its hold upon the bottom, and then only to the main body of the current the lateral spread of which is disputed, inch by inch, by this saturated "snow-ice."

This ice is drawn into mill-races at the head of rapids wherever there is too much current, or a lack of depth, and coming down to the racks is sucked against the grating, completely stopping the water like so much wool. At tail-races, where the same faults of construction exist, it "grows" upon the bottom, setting back the water and stopping the wheels. Many mills are rendered useless during the winter months from one or both of these causes.

Although a sounding pole will pass readily through a bank of anchor ice, it cannot be easily penetrated or displaced by bodies having any considerable base. In order to sink a crib for a bridge pier, below one of the rapids in the Little River, the site was cut out upon the surface ice, the crib framed in its place and filled with stones; after sinking a certain distance its progress was arrested,—although the sounding pole shewed that it was still about ten feet above the bed of the river. No additional weight which could conveniently be placed upon it would force it any lower, for it was found to be resting upon a bank of "frozee" (*frasil, fr.*) or anchor ice. The obstruction was only got rid of by the tedious process of detaching, by means of long poles, small pieces at a time from the lower side, which floated down the stream.

In the little which has been written upon the subject of anchor ice, it has been doubted both that it is formed upon the bottom, and that ice so formed rises to the surface; or whether the anchor ice seen upon the surface, was either formed or had rested upon the bottom. Among practical men, millwrights and lumbermen who have been puzzled by the phenomena attendant upon it, there is similar diversity of opinion. It has, however, been observed in situations where it would seem impossible that it could have been deposited unless formed where found. It has been found upon smooth rock in rapid water ten feet in depth ; and it has been seen to burst up from the flat rock bed of the St. Lawrence, at the head of the Longue Sault rapids, where there is a depth of twelve feet. I have seen it rising to a surface already nearly covered with it, and at the same time, have felt it with a pole upon the stony bottom in upwards of twelve feet of water.

A remarkable instance of the formation of ice under a considerable depth of water occurred in the winter of '56–'57, at New York. The gutta-percha pipe—about 2½ inches diameter—which supplies "Blackwell's Island" with Croton water, was frozen solid while resting on the bottom in a tide way at a depth of at least twenty-five feet below the surface. The flow in the pipe had been arrested by an obstruction, and the East River was at the time covered with floating ice. As the water within the pipe was fresh and very pure it could become solid while the surrounding salt water remained liquid, but it *may* have been over-grown with anchor ice.

The temperature of running water falls considerably below 32° without congealing, and therefore anchor ice is not melted. It is probably often formed in water at a temperature as low as 28° or 29°, which is not impossible if the air is 30° below zero ; and although no anchor ice is formed under the solid surface ice, that which has been carried there does not melt,—shewing that the water in motion under the surface ice below rapids does not soon recover the warmth it has lost in traversing the shallow open reaches above.

The appearance of the open water above the Lachine Rapids, after a cold period, seems to prove both the place of origin and the fact of rising of anchor ice ; but *how* it is formed, and *why* it rises, are questions of interest which I have never seen explained, and to obtain answers to which is the object of these notes.

With respect to the mode of formation, it is analagous to that by which dew or hoar frost is formed on the surface of the earth, and is probably due to radiation from the warmer bed of the stream to the colder surface current, and still colder atmosphere. When the temperature of the air rises above 40°, the surface of the snow covered ground remains colder than the atmosphere, and radiation ceases. When it ceases the power which kept anchor ice at the bottom is suspended ; and from this circumstance, and the regular rising of the ice, there is reason to suppose that radiation is but another term for magnetism in some of its varied forms.

With respect to the still more subtle question of its rising only when a change of temperature takes place to a certain extent, this is analagous to the fact that very cold metal adheres to the hand, lips or tongue with force sufficient to remove the skin, until the relative temperatures are altered, whereupon it loosens its hold. Here again change of temperature is another name for the cessation of an active force.

Whether the specific gravity of anchor ice, while it remains upon the bottom, is greater or less than that of the water above it or whether it is retained there by pressure or frost, may be questioned; but if this ice be more æerated than surface ice, the combined effects of increased and maximum density of water between 39° and 40° fahrt. (at about which temperature anchor ice leaves the bottom), and of the expansion of the contained air, with possibly some diminution of barometric pressure, may have something to do with its rising.

When water is at the temperature of about 40° Farenheit, its density is greatest; when colder or warmer than this, it is lighter. In summer it is always above 40°, and then surface water is lighter because warmer than that below; but in winter this is often reversed: the surface water is lighter because colder than that below, and this cold stratum of water in rapid motion acts on the bed of the river like a cold wind on the human body, producing such rapid radiation and extraction of heat as to cause the peculiar form of congelation known as anchor ice. This process must be accompanied by some decomposition, or by a rearrangement of the air evolved,—as anchor ice when at the bottom, if stirred, sends up numerous air bubbles of considerable size, and it is perhaps owing to the presence of this and its expansion that it rises so rapidly. When by an atmospheric temperature above 40°, the upper and lower strata of water change places, the current of electricity between the earth and the atmosphere is reversed,—the magnetic tide ebbs—radiation ceases, and the relative specific gravities of the anchor ice and its water envelope being altered it is detached from the bottom.

Anchor ice seems to bear about the same relation to solid ice which muscovado or granulated sugar does to that in the lump or cake. There is also a certain degree of similarity in the conditions under which the processes of solidification are in both cases carried on. The compact masses are formed by cooling in a state of comparative repose,

—the granular ones by agitation and consequent æration. If we refer to the effect of friction upon the sides and bottom of the channel—giving the least velocity to the current at those points, we have the retarding cause *where* the ice formation takes place, and yet a disturbing cause which independent of its submerged position may be sufficient to produce the granular formation. If the cold superstratum of the flowing water (which from its specific gravity at the temperature under which anchor ice is formed, confines the substratum *in sitû*) may be supposed to act upon the bottom in the same manner as the colder atmosphere upon the surface water,—the principal point of difference would be whether the air disengaged in the process of freezing would pass off, or enter into any new combination and form anchor ice as snow is formed in the atmosphere. There is much similarity between saturated snow and anchor ice. Heavy snowstorms, when the water is very cold, produce the same effect upon the river as anchor ice: the snow does not melt but, descending the current, passes under the solid ice and clogs up the channel. The specific gravity of saturated snow and anchor ice appear to be equal and almost identical with that of the water.

One consequence of this peculiar form of congelation may be briefly referred to. The great rivers of Canada, the St. Lawrence and the Ottawa, with the large majority of their tributaries, are terrace-like in their profile, as contrasted with the easy and almost uniform slopes of the Mississippi and its branches. At the outlets of all our lakes, large and small, there are rapids with open water in winter to a greater or less extent. During the most intense cold—20° to 30° below zero—this open surface is covered with white fog or mist, like frost rime, completely hiding the dark water which is beyond the snow-covered bordage and appears to extend across the river—a deception which has lured many an unwary traveller to a frightful death.

While the surface of these lakes and rivers is covered with ice, and the earth with snow, with the sun almost powerless, the amount of latent heat disengaged in the formation of anchor ice and sent up from these numberless breathing holes may give a powerful check to the duration of that severe temperature under which this peculiar description of ice is so abundantly formed.

The unexpected rise of the St. Lawrence above the Lachine Rapids in January, 1857, suggests some questions of moment. Suppose the cold term had continued another day, would the growth of anchor ice have continued at the same rate? if so, it would have driven the river out of its bed—and many an unfortunate dweller on its banks out of their beds also. There is every reason to fear that the growth is more rapid after it can be measured by feet than while it is confined to inches; and then the question comes, could such a state of things continue for another day? or is there, either in the intensity of the frost or in the volume of icy moss produced by it, an antidote to the evils threatened by them? An all wise and merciful Power prevents our rivers from becoming solid masses of ice by the apparently paradoxical law, that in winter the bottom waters shall not rise to the surface to be cooled, although in summer the great lakes thus temper the intense heat; and may there not be the same beneficent and self-regulating provision by which intense frost—which is but the result of magnetic activity—produces its own antidote? If there is not, the day may possibly come when the St. Lawrence will, for a time, take the direct railway route from Lachine to Montreal, a valley it once occupied, but whether as a winter channel or otherwise geologists must decide.

# AN INQUIRY INTO THE NATURAL LAWS WHICH REGULATE THE INTERCHANGE OF COMMODITIES BETWEEN INDIVIDUALS AND NATIONS, AND THE EFFECTS OF INTERFERENCE WITH THEM.

BY REV. WILLIAM HINCKS, F.L.S., ETC.

*Read before the Canadian Institute, March 29th,* 1862.

The subject I have undertaken to discuss this evening, is somewhat too extensive for the time I can presume to occupy, and is one upon which I cannot pretend to throw any new light; but it is one of great and general interest, any doubts and difficulties relating to which may certainly be settled by reasonable inquiry; and having a strong conviction myself, which is not, I may safely say, a mere acceptance of the authority of others, however high in public estimation, but the result of personal inquiry and examination of evidence, knowing also how many around me take different views, which they doubtless think important, I have judged that a correct summary of what seems to me the real state of the case might not be useless, or, as a discussion of a controverted point in science, altogether out of place, and if I should influence those who think me mistaken, to express and defend their sentiments, I shall, as seeking only what is true and consequently useful, be pleased to listen to their remarks, and to contribute, through them, to your satisfaction.

I begin, then, by observing that man is naturally disposed to barter or exchange objects which by his exertions he has produced or appropriated. Other animals quietly use what comes in their way, or obtain what they want by violence or artifice: few accumulate, and those few are among the less intelligent; and only under the guidance of mere instinct, prepare for changes of the seasons. Animals will fight for the possession of a desired object: they will seize or steal from others what they want; but the voluntary giving up of anything in order to obtain another thing, is unknown amongst them, and is above their comprehension. Man, in a rude state, imitates the violence; in a corrupt and degraded state, the fraud of the brute,—both of which civilization, knowledge, and moral improvement lead him, for his own good as well as that of others, to abandon; but with the reason God has given him, it requires but small progress for him also to seek advantages by barter. He is sometimes successful in obtaining more of a desirable object than he can immediately consume; and he perhaps finds, when labouring for any product, a very slight additional exertion will greatly increase the quantity obtained. In these circumstances, to a reasoning animal, the idea of barter, as a means of increasing his advantages, naturally suggests itself; nor can the principle have been long applied before it was found out that each one doing what he liked best, or was most skilled in, would produce a much larger amount altogether of all desirable things, and a better share to each, than every one providing as nearly as possible all things for himself. Thus intimately is the tendency to barter connected with the division of labour. The earliest exchanges would of course be conducted with very imperfect approximations to accuracy in valuing—inexperience and the force of desire rendering the terms arbitrary and unequal; but it would soon be found that objects are valuable in proportion to the time and labour required for obtaining them; and not only the immediate time and labour, but that which had been employed in acquiring knowledge, skill, and quickness, so as to do most and in the best manner, as well as that accumulation of the results of previous labour which enables a man to live whilst working at an object, and to obtain whatever he needs for its completion. It is evident that no one would give a price for what he could as easily take without it: but if social order will not permit the stronger to take from others against their will, what is not to be had everywhere and without exertion, must be obtained either by our own labour directly employed upon it, or by an exchange for it of the produce of our labour otherwise employed; and the natural measure of price is, that results of equal amounts of labour and skill have the same value.

Such slight disturbing causes need hardly be mentioned in this connection as that needful labours which are peculiarly disagreeable, and which almost everybody would gladly avoid, must be paid for somewhat more highly, to induce some to undertake them; whilst those which are most liked, and which great numbers are very willing to perform, meet with a smaller return; or that he, whose skill and industry can produce most of a desired article in a given time, will have the full benefit of his superiority,—since equal quantities of the same thing will have equal value, by whomsoever or in whatever time prepared. Hence, also, when the quantity of the return for labour depends on situation, the weather, or any cause not easily calculated before-hand, the peculiar success is like all advantages unequally scattered by Providence, and the amount of gain is disconnected from the amount of labour, price here obviously depending on the labour others must undergo to secure the same products, or if they are scarcely attainable by labour, on what others will give rather than do without them. Whenever, from any cause, more people want to obtain any article than the producers of it can supply, its value, compared with other things, must rise. Whenever, on the other hand, more of the article is offered for exchange than is wanted, its comparative value must fall. When in any community the quantity of an article wanted is within, or at least does not exceed, what some members of the community can supply in return for things which they want, price will be regulated by the amount of labour expended on each article; but any limit to the supply, or difference in the quantity of labour different individuals must bestow in order to maintain it, will immediately and necessarily affect price. If only a certain quantity of a product can possibly be procured, and a greater quantity is sought for, the price is what a sufficient number of persons to take the whole supply are willing to give rather than not have the article. If a *certain* supply can be procured at any given cost of labour, but the quantity can only be increased by a greater expenditure of labour, then all that is consumed will have for its price the amount of labour expended on that portion, however small, which requires the greatest cost to produce it; for it is clear that no one would exchange the article for less than *the labour he had expended* in producing it; and whilst *one* who assists in supplying the market requires a certain price, all the others feel themselves equally entitled to it,—their power of producing their share of the supply at less cost, is a natural advantage of which they of course avail themselves.

Two remarks may be needed to guard what has been stated from misapprehension. 1st. That capital being nothing else than accumulated results of labour employed for further production, the degree in which it has contributed to the production of the article does not affect what has been affirmed. Capital contributes to the goodness and cheapness of very many things, but does not alter the natural laws which determine price. It is indeed quite true that the price of commodities produced by the union in various proportions of capital and labour, will be, according to those proportions, affected by the changes separately produced by competition or otherwise in the value of each; and these circumstances would explain peculiar changes of price in certain commodities, and afford reasons for probable success or failure in certain kinds of production in particular situations, but they would not withdraw these commodities from the dominion of the general laws respecting exchange, and what belongs to the special cases does not require investigation in reference to our present subject.

2nd. The exchange being direct of products themselves, or being accomplished by the intermediation of what we call *money*, cannot any otherwise than nominally affect price. What we call money is itself a commodity. Paper can have no value worth speaking of but as a convenient mode of handing about a right to a certain quantity of gold; and the gold itself is appropriated and brought to market by human industry, and finds its value like all other things. Because it is eminently suited for the purpose, portions of it are used in exchange; but we know when price varies, that gold growing cheaper or dearer may be the cause, as well as other articles of produce altering their comparative value.

We may now rest in the conclusions :

1st. That the natural tendency of price is towards the equivalence of products of equal amounts of labour.

2nd. That what may be called the natural price is modified by the abundance or deficiency of supply in relation to the wants of a particular community at a given time, *i.e.* in proportion to the *demand.*

3rd. That a special power of producing some object of desire which others cannot produce, or of producing it better and at less cost of labour than others can, enables an individual or class of persons to secure an increased price—the measure of which is the price at which others can afford to sell the same article, if there is a full demand ; or otherwise, just as much below it as will attract all the custom : whilst when the power is exclusive, the price will be the most that a sufficient number of persons to take all that is produced will pay, rather than go without the product.

The cases under the last head may very properly be termed *natural monopolies.* They are unavoidable, and involve no grievance ; but they manifestly raise the cost of gratifying some desires and give advantages to some indivividuals ; and we see that their action on prices is the same as that of what really constitutes a monopoly, which is an interference of power to limit to one individual or to a certain class the sale of any particular commodity. It is very important that we should see clearly what happens in this case. It cannot be accounted a doubtful matter ; but it may, notwithstanding, be worth while to illustrate it by applying the principle on a small scale where its operation cannot escape us.

Let there be a small community,—say of two hundred individuals, —all desiring a certain product of industry, the natural price of which for a given quantity we will express by (*p.*) Some authority interferes, and gives to the man A. B. the exclusive right to deal in the article. Before this event it must have been sold for something about the natural price which would afford the usual return, such as would be obtained in other employments, for the labour required in bringing it to the market ; and if A. B. had demanded a higher price, others would have found the usual return for labour sufficient to induce them to enter into competition, and his trade would have speedily come to an end. But as soon as a sufficient authority has given him the exclusive privilege of sale, A. B. adds a quantity $(x)$ to the price, raising its amount until he finds the utmost which will be given for all that he can offer. Some who would have paid the natural price are thus deprived of the article. We will estimate them at 20, and the remaining 179 pay for its use $(p + x)$, where they need only have paid $(p)$; whilst A. B., in addition to the fair and just reward of his industry, has extorted from the little community 179 $(x)$, the amount of $(x)$ being only limited by the desire felt for the article, and this excessive charge on those who could bear it being accompanied by the total privation of the rest of the community. The essence of monopoly is obtaining from every consumer something more than the just price of the article, as settled by competition in a free market, whilst the number of consumers is more or less reduced by this rise of price. You will all at once apprehend that besides the simple and somewhat rude method employed by arbitrary sovereigns, of bestowing on individuals exclusive privileges, there are other ways by which the same ends can be obtained. Let a government lay a heavy import duty on an article desired by many, which can be most cheaply brought from another country. Something more than the duty is of necessity added to the price, and this rise may be sufficient to enable a home producer to supply the article at a trifle below what it now costs when imported. The hasty conclusion is, that you have encouraged home industry. The fact is, you make all the community, which may be a very large one, pay $(p + x)$; which latter may be a not inconsiderable proportion of the whole, for what had before only cost them $(p)$; and you give the home producers possibly some million times $(x)$, which is positively stolen from the rest of the community, who would be at least as well served at the price $(p)$.

No one can, I think, attempt to establish any difference between the case of nations, which are but collections of individuals, and that of individual members of one nation. It is even evident that from the various natural productions and resources of different regions, which commerce is the benevolently provided means of interchanging and equalising for the general good, the freedom of commercial intercourse between different nations is more important than that between members of the same community, which nevertheless cannot be restrained without the most obvious evil and injustice. The character of all commercial restrictions seems then to be pretty clearly made out, as in effect amounting to a robbery of the multitude for the benefit of a few; and a thwarting, as far as our power goes, of the great providential plan for the free diffusion by human industry of all the bounties of nature and the conveniences of art over the whole world.

But it is thought by some, that the excessive payment (for the moment we will abstain from calling it by its proper name *plunder*, which it deserves, as being forcibly extorted by the agency of power) made for home products, is more than compensated by the advantages derived from their being produced at home; and also, that allowing the principle of restriction not to be good in itself, it may be made desirable and almost necessary by the conduct of other nations towards us. It may also be said—and we all know that it is maintained—that the requirements of a country in the way of revenue, may justify high duties on imported products, and that if these duties encourage home production, this benefit repays us for the evil they inflict. To these points, then, we will in conclusion direct our attention.

As to the first point, I believe there can be no question raised in relation to the facts to be considered. On the one hand, no one denies or doubts that increase in the quantity and variety of the products of industry in a country, is a blessing to its inhabitants, provided it is not extravagantly paid for; and it is evident that an artificial raising by commercial restriction or a heavy import tax of the price of an article, will afford an opportunity to home producers, who before could not compete with the countries already advantageously engaged in this particular branch of industry. On the other hand, this very statement of the way in which benefit is sought, admits, and it is indeed undeniable, that we pay more for the new production than we need do for a similar or better article imported. We should pay to the importer the natural price, depending only on the labour, immediate or capitalized, which has been employed, and on the usual rate of return for it. We pay to the home producer that price—the ($p$) of our previous statement) with the addition of a quantity ($x$), expressing the amount that the price is raised by the duty imposed. The whole body of consumers,—probably many thousands,—are taxed to this extent for the sake of having the article produced at home instead of abroad.

It is said that the benefit consists in employing a greater quantity of the labour of our own people, and in avoiding sending money out of the country. Our inquiry may then be confined to the questions, Whether a greater amount of home labour is really permanently employed? Whether our money going out of the country is really the evil supposed? And whether the advantage gained, if any, is worth the sacrifice required? The employment of labour necessarily depends on there being work which wants doing, and the means of paying for it. In most countries, and above all in new countries, there is plenty of work which wants doing; its execution only awaits there being means of paying for it. It is work which would be profitable, but means in advance must be first acquired. The amount of labour employed depends, then, on the amount of capital that exists in the country, or can be drawn in from other countries. Some occupations, indeed, can only be carried on advantageously with very cheap labour; and where the rate of wages is ordinarily high, can hardly exist. But a higher rate of wages is on the whole a public benefit; it is an advantage to the great body of society, and shows progress, because it could not possibly be sustained without demand for labour. Where the employment of capital is attended with such profit that the returns for it are usually high, it is manifest that the present capital of the country is not equal to the means of advantageously employing it, and consequently that new employments for it are not urgently wanted. Where the rate of wages is on the average, and, as compared with many countries, high, new demands for labour tend to raise it yet higher,—thus increasing the cost of every product; and it must be cheaper to import than to make many things that are wanted, in all countries not greatly advanced in their career, even independently of natural facilities for particular pursuits enjoyed by other nations. Where they can be advantageously conducted, manufactures rise of themselves, or with that degree of fostering which consists in giving information. First come those which are required in the neighbourhood, and are sufficiently occupied in supplying its wants; then those which diffuse their products over a wider field; and last of all, and only under peculiarly favourable circumstances, those great enterprises which aim at supplying the markets of the world. The latter require for success cheap capital, cheap labour, the most perfect machinery, the best power on the best terms, and easy access to the best markets. They grow; but they are not hot-house plants, and cannot be forced. Profitable manufactures are a general benefit, increasing national wealth. But if a very rich man resolved to have manufactures, and maintained some great undertaking at an annual loss, he would not benefit his country,—since he would annually diminish the capital possessed within it, and would create expectations of employment which must ultimately be disappointed. But in protected manufactures, the real loss is divided amongst all the consumers in the form of increased price above what they need pay. It may be left to any man of sense to judge whether a country profits by such means.

The evil of money going out of a country is the merest fancy. Men produce that they may enjoy or accumulate. In producing, they increase national wealth; in enjoying, they of necessity employ the industry of others; in accumulating, they increase the capital which is the grand means of national progress. What they want, they should get where they please, which will generally be where it is best and cheapest. They exchange their own produce either for what they want or for something which will purchase what they want; and to the country it matters not which—the saving made by the cheapness of a foreign production being employed at home, and whether what the individual produces or what he obtains in exchange for it, called money or not, is sent to purchase what he wants, being perfectly indifferent. The proper estimate of national wealth has nothing to do with money brought into or sent out of a country. If our industry produces something which many persons want, at least as cheaply as it can be supplied by others, then we are increasing our own wealth and our country's; and the latter addition is not a mere verbal one, for the presence of our wealth in our country is naturally a means of employing its labour, and promoting, with advantage to us personally, improvements which benefit all our neighbours. What we produce is intended to be exchanged either for what we immediately want, or what we find it expedient to hold as a means of satisfying future wants, or promoting further production. If we were compelled to exchange only for what is produced near us, our enjoyments and means of profit would be greatly limited, and consequently we should have much less inducement to industry in producing, to the great diminution of national wealth. Some countries can, from their climate, produce what we could not obtain at any cost: some can produce things which we want, from natural or incidentally acquired facilities, much more cheaply than they could possibly be obtained by us at home. We exchange a portion of our produce for these things;

thereby making the most of our industry. Whether we send out the actual commodities we have produced, or the gold we have bought with those commodities, is of no consequence whatever to national prosperity, which is advanced by all our successful industry, and could only be retarded by artificial checks on our freedom to try and benefit ourselves.

Now let us suppose that some protected manufacture does find out and employ possible labour, which was otherwise lost; and let us admit this to be a benefit—though perhaps it is chiefly labour of young persons who would be better at school, and whose parents, with industry and economy, could afford to keep them there—the benefit, such as it is, has been obtained at the cost to the country of the whole difference between the natural and the protected price of the article; which sum, if not thus paid, would either have been spent in employing labour, or, which is nearly the same and even still more useful, would have become capital. Now will any one explain how much is gained, or venture to affirm that the good is worth its cost?

The next question for our consideration is, assuming restriction on the freedom of exchange of all commodities to be an evil, but supposing another nation with which we might deal to have ignorantly adopted it, what effect should that circumstance have upon us? The restriction shuts us out of a market, and is thus a real evil to us. But in consequence, we shall either give our industry some other direction or find out some other market, and the evil may not be great: whilst to the people at large, which lays on the restriction, the loss from it must be a very heavy one—a general tax for the benefit of a class, blindly and unwisely submitted to. There is something which that country has to sell which we want; if we buy it, we do so because we want it, and can get it best there. If as a nation we shut it out, we tax our own people to spite our neighbours, or to show them that we approve what they do, and can be quite as unwise as they. What other benefit we gain by refusing to buy in a convenient market, I confess passes my comprehension.

Our third and last inquiry is, whether the duties on imports required for revenue can be so managed as to stimulate home production, and thus diminish at least their unavoidable evils. It ought surely to be sufficient to observe that, in the supposed case, the country requires the revenue; so soon, therefore, as the duties become protective, that is, that they cause the article to be supplied in the country without paying duty, additional taxation must be laid on to supply the deficiency. Protection and revenue are in this case directly opposed. Where a duty begins to encourage home production, it has already ceased to yield revenue. Revenue depends on free consumption. Tax as many things as you can, but always moderately, so as to interfere as little as possible with the use and enjoyment of the article,—and the revenue flourishes, not indeed without a certain amount of evil, yet without causing any suffering which is greatly felt, and probably at the least expense of injury which is attainable, except through that grand resource which can only be employed by an eminently enlightened and virtuous nation—direct taxation on the whole property of the country.

I know well in what various lights this subject might be put, and in how many forms the prevalent fallacies might be arranged,—each of which might, without much difficulty, be exposed in its weakness or selfishness; but I believe I have essentially proved that restrictions on commerce have the effect of monopoly, in enabling a class to live by a tax on the rest of the community, added to the fair natural price of the commodity, which is to prove that common justice, as well as wise policy, requires the utmost attainable freedom of trade; and that the natural laws, according to which the products of industry exchange, are essential and irreversible: hence if we understand them, and act in conformity with them, we derive the benefit of our knowledge; if we ignorantly or obstinately resist them, we invariably suffer the consequences,—the whole body being injured excepting the few who fatten on the plunder of their fellow-citizens, and would gladly confound their own with general prosperity.

# AGE OF THE ORISKANY SANDSTONE.

*To the Editor of the Canadian Journal.*

Dear Sir,—To determine the relative age of a formation may appear to some persons a small matter and easily accomplished; such is the case in most instances. When the agencies which have been at work during any period are well understood, and where the flora and faunæ are clearly defined, it is generally easy to determine the horizon which separates the group of rocks to which they belong from others either above or below. But there are cases in which this line of separation is very obscure, so that whether a formation belongs to this or that group becomes a question not so easily decided. Such you are aware is the case with respect to the Trenton Limestone in Canada, which, in the United States, the New York Geologists divide into three formations, each characterised with good natural horizons of separation. This is the question at issue respecting a primordial zone in America; and the same difficulty is experienced in fixing the age of the Oriskany Sandstone formation.

This formation, though of little thickness, has a very wide range —extending from the Peninsula of Gaspé to Lake Huron. It is generally regarded as belonging to the Devonian, and forming the base of that system, while some authors think that it should be classed with the Upper Silurian. These gentlemen base their conclusion upon pæleontological evidence. It is not my intention to discuss that evidence, but simply to furnish a few facts which appear to bear upon the subject, and lead to an inference quite contrary to that come to by those who class it with the Silurian.

Beneath the Oriskany Sandstone in Western Canada occurs a group of rocks, known as the Onondaga Salt or Gypsiferous group. The following ascending section of a few of the upper beds will be sufficient to explain their character:—

| | ft. | in. |
|---|---|---|
| Brownish grey shaly limestone ............................... | 5 | 0 |
| Water lime containing Eurypter sus (?) ...................... | 2 | 6 |
| Hard grey shaly limestone weathering brown...... ..... | 1 | 0 |
| Hard porous brownish drab crystalline limestone, in beds of from 1 to 3 feet in thickness...................... | 5 | 0 |
| Thick-seamed conglomerate limestone composed of a light grey paste, holding small angular masses of a more compact, hard, dark grey coloured lime with a brownish tint, the whole yellowish on weathered surface .................................................. | 4 | 0 |
| Porous grey limestone, containing numerous irregular bluish bands, lighter coloured on weathered surface, | | |

| | ft. | in. |
|---|---|---|
| interstratified with thin seams of finer grained lime, holding light yellowish nodules weathering almost white, and thin seams of dark coloured shale with a bituminous odour............................................ | 20 | 6 |

Chert occurs in the light grey limestone which forms the summit of these rocks, in the form of nodules, seams, and miniature dykes. The nodules are found in a few instances only, while the seams and dykes are of frequent occurrence. The upper beds of this rock are also cut by dykes of sandstone. One of these, nearly a foot in width, is stretched across the bed of a creek, and is hidden on both sides by the bank. From 12 to 15 feet of it may be seen. They are, however, usually much smaller.

Above the Oriskany Sandstone occurs the Corniferous Limestone. This consists of beds of limestone containing vast numbers of cherty nodules, or beds of limestone interspersed with seams of chert.

Nodules of chert every way similar to those of the Corniferous, are found in the Oriskany Sandstone.

From these facts we think the following inferences may be very naturally drawn: 1st. That after the Onondaga rocks had been deposited they emerged from the ocean, and the exposure to the weather produced the fissures which are now filled with chert and sandstone forming dykes.—2nd. That at the time of the submergence, there was ushered in a condition favourable to the deposition of chert. The inference that the Onondaga rocks were hardened before the deposition of the sandstone, is also supported by the fact that in some places large quantities of pebbles of Onondaga rock are found in the sandstone.

The inference that the same state of things existed during the Oriskany Sandstone period that prevailed during the Corniferous age is supported by the fact, that nearly all the Oriskany fossils are found in the Corniferous, and many Corniferous forms are found in the sand. Mr. Billings has described the following species as belonging alike to both formations:—*Atrypa reticularis* (Linn); *Stricklandia elongata* (Billings); *Pentacrinus aratus* (Conrad); *Centronella glansfagea* (Hall); *C. tumida* (Billings); *C. Hecate* (Billings); *Septocelia concava* (Hall); *S. flabellites* (Conrad); *Chonetes hemispherica* (Hall); *Strophomena ampla* (Hall); *S. perplana* (Conrad); *S. Patersona* (Hall); *S. Inequistriata* (Conrad); *S. rhomboidalis* (Wahlenburg). I have also found the following Corniferous species in the Oriskany:—*Zaphrentis spatiosa* (Billings); *Z. prolifica* (Billings); *Michelinia convexa* (Dorb); *Favosites hemispherica* (Yandell and Shumard).

It is plain from the facts above stated, that a considerable time elapsed between the deposition of the Onondaga and the Oriskany Sandstone formations; and it is clearly shewn that the condition favourable to the deposition of chert commenced previous to the deposition of the sand. If, then, there is no doubt that the succeeding strata belong to the Devonian, it must seem reasonable to place the Oriskany in that system to which in so many ways it stands the more closely related.

JOHN DeCEW,
*P. L. S.*

CAYUGA, June, 1862.

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## METEORIC STONES IN INDIA.

The following documents relating to a fall of Meteoric stones in India, afford a pleasing proof of the interest felt by Her Majesty's representatives in all parts of the world in collecting and making known facts bearing on scientific inquiries, and they possess a special value from the authentic character of the information communicated. We lay the whole before our readers, with a thankful acknowledgement of the attention of the late Governor General in communicating the papers to the Canadian Institute.

GOVERNOR'S SECRETARY'S OFFICE,
Quebec, September 21, 1861.

SIR,—I have the honor, by command of His Excellency the Governor General, to enclose a copy of a letter from the Under Secretary to the Government of India, and a printed paper and specimen of a Meteoric stone therein referred to; and to request you to present them to the Canadian Institute.

I have the honor to be, Sir,
Your obedient servant,
FRANCIS RETALLACK,
*Acting Governor's Secretary.*

Professor Wilson, LL.D., &c., &c., &c.,
President Canadian Institute, Toronto.

*Copy.*

*No.* 3506.

From C. U. Aitchison, Esquire,
*Under Secretary to the Government of India,*
To the Right Honorable
Sir Edmund Walker Head, Bart.,
*Governor General North American Colonies, Canada.*

Foreign Department,
Fort William, 1st July, 1861.

Sir,—I am directed by His Excellency the Governor General of India in Council, to forward to you a packet containing a specimen of a Meteoric stone that fell at Dhurmsalla on the 14th July, 1860, and to request that you will be so good as to present it to the Canadian Institute.

A printed paper giving an account of the fall of the Meteorites is enclosed.

I have, &c.,
(Signed,) C. AITCHISON,
*Under Secretary to the Government of India.*

Fort William, 1st July, 1861.

*Copy of a letter from the Deputy Commissioner, Dhurmsalla, to R. H. Davies, Esquire, Secretary to Government Punjab, No.* 927, *dated the* 30*th July*, 1860.

I have the honor to submit for the information of the Hon'ble the Lieutenant Governor a full account of a Meteorite that fell at Dhurmsalla on the 14th instant.

2. In the afternoon between the hours of 2 and 2.30 p. m., the Station of Dhurmsalla was startled by a terrific bursting noise, which was supposed first to proceed from a succession of loud blastings, or from the explosion of a mine in the upper part of the Station, others imagining it to be an earthquake or very large landslip, rushed from their houses in the firm belief that they must fall upon them.

3. It soon became apparent that this was not the case. The first report, which was far louder in its discharge than any volley of artillery, was quickly followed by another and another to the number of 14 or 16, most of the latter reports grew gradually less and less loud. These were probably but the reverberations of the former, not among

the hills but amongst the clouds, just as is the case with thunder. It was difficult to say which were the reports, and which the echoes. There certainly could not have been fewer than four or five actual reports. During the time that the sound lasted, the ground trembled and shook convulsively.

4. From the different accounts of three distinct eye-witnesses, there appears to have been observed a flame of fire described as about two feet in depth and nine feet in length, darting in an oblique direction above the Station after the first explosion had taken place. The meteoric flash was said to be N. N. W. to S. S. E. Fragments of ærolite fell in the same direction at the following places:—

In the ravine below the Dhurmsalla Kotwallee at the Village Sadeir.

On the Barrack hill close to the Convalescent Depôt.

At the River Guj four miles from the Kotwallee.

On the Parade ground of the Sheredil Police Battalion between the graveyard and the Native Distillery.

In the Village of Kerayree on the hill to the right of the Station looking towards the plains and at the Bowarna Thannah.

It must be noted that Kerayree, the Barrack hill, the Kotwallee Kudd, the Graveyard and Bowarna are in one direct line from N.N.W. to S. S. E.

5. Specimens from each of the above localities have been brought into the station.

6. It is said that meteoric stones fell likewise in the following places, but no specimens have been received from them. At Kunhiya near the slate quarries, at Madhopore, and at Bissowlee on the Ravee, and in parts of Chumba and Rhilloo. I am making further enquiries with regard to these places.

7. The stones as they fell burried themselves from a foot to a foot and a half in the ground, sending up a cloud of dust in all directions.

8. Most providentially no loss of life or property has occurred.

9. Some Coolies passing close to where one fell, ran to the spot, to pick up the pieces. Before they had held them in their hands half a minute they had to drop them owing to the intensity of the cold which quite benumbed their fingers.

10. This, considering the fact that they were apparently, but a

moment before, in a state of ignition, is very remarkable; each stone that fell bore unmistakeable marks of partial fusion.

11. The morning and afternoon preceding the occurrence had been particularly dull and cloudy. The temperature was close, sultry, and oppressive. The Thermometer was above 80 degrees of Fahrenheit, and no rain had fallen. I had no Barometer by me at the time, I am therefore unable to state what was the precise pressure of the atmosphere. The clouds which were of the form technically called cumulus and cirrus were hanging low at the time, and the atmosphere was heavily charged with electricity.

12. Such are simply the facts of the case as they occurred.

13. There are of course all sorts of conjectures as to the probable cause of the occurrence: some state the stones to be of volcanic origin, others that they were hurled from the heights about the Station, or projected from the moon, but I am inclined to regard them as real *boná fide* Meteorolites. Their weight seems to indicate that they are semi-metallic substances, composed probably of Meteoric iron alloyed with nickel, and mixed with silica and magnesia, or some other earthy substance. They are nearly double the weight of a piece of ordinary stone of similar dimensions.

14. Such a phenomenon is not without precedent. It is on record that in Siberia a mass of iron once fell weighing 1,680 lbs., and in Brazil another weighing 14,000 lbs. In Peru a piece fell weighing 15 tons, and it is said that some knives of iron alloyed with nickel were found by Officers connected with the Arctic expedition among the Esquimaux in Greenland, which must have been made of metal taken from Meteoric masses, for these two metals are not found together as a mineral product anywhere.

15. I have sent specimens of the Aerolite to the Museums at Lahore and Umritsur, and to Scientific institutions in America. I am about also to send others to the Academy of Sciences in France, to the Asiatic Society in Calcutta, and to Monsr. H. Schlagentweit at Berlin in Prussia, for examination and report.

16. One fact if true is curious, *viz.*, that the report preceded the flash instead of followed it; this I cannot at all account for.

17. The common theory with regard to such phenomena is that they are fragments of some planetary body of our system which has been destroyed, and these portions as projected into space, have acci-

dently come within the sphere of the earth's attraction, which extends to about 45 miles above the surface, and consequently fallen on it. Some believe that the tail of a Comet coming in contact with one of the minor Planets, or asteroids annihilates it instantaneously. Indeed in England when the Comet which was predicted to appear next month was discussed, some said that if the length of the tail were to extend over half the area of the heavens, the safety of our own Planet would be in jeopardy.

18. I believe that I was the first at Dhurmsalla to discover the new Comet now visible in the heavens. I saw it first on the evening of the 4th July, and I have met no one yet who will allow that there is a Comet ; subsequent accounts in the papers prove that I was correct.

19. Another very singular phenomenon was witnessed at Dhurmsalla on the evening of the same day that the aerolite fell. This appears to have been a succession of igneous meteors such as fire-balls or falling and shooting-stars.

This singular sight did not attract the attention of most people. I quote the account (from the writer who describes it) verbatim : "I think it was on the evening of the same day that the Meteor fell, that I observed lights in the air, they commenced to appear about 7 p. m., and lasted about three hours till 10, they appeared for about one minute, some for longer, then went out again, other lights appeared in the same place, some times three or four lights appeared in the same place together, and one or two moved off, the others remaining stationary, they looked like fire balloons, but appeared in places where it was impossible for there to have been any houses, or any roads where people could have been, some were high up in the air moving like fire balloons, but the greater part of them were in the distance in the direction of the lower hills in front of my house, others were closer to the house and between Sir Alexander Lawrence's and the Barracks. I am sure from some which I observed closely that they were neither fire baloons, lanterns, nor bonfires, or any other thing of that sort, but *bonâ fide* lights in the heavens. Though I made enquiries amongst the Natives the next day, I have never been able to find out what they were or the cause of their appearance."

20. Verily this has been an extraordinary season in more ways than one.

21. In different newspapers I have read accounts of other very extraordinary phenomena all occurring within the last few months,

for instance an aërial meteor or water-spout in the neighbourhood of Bhurtpore where aerolite is said also to have fallen. A luminous meteor or something which from the newspaper account reads like an Aurora Borealis at Delhi. This was on the night before the Meteorolite. A shower of live fish at Benares unaccompanied by rain. A similar shower but accompanied by rain fell some years before at Agra. A shower of blood at Furruckabad, and likewise at Meerut previously.*

Also a dark spot observable on the disc of the Sun.

22. Besides the recent shock of an earthquake slightly felt here, there was an unnatural yellow darkness of some duration, followed by a violent wind storm from 3 p. m. to 5 p. m. on one afternoon early in the present month. These were all more or less strange phenomena.

22. Two descriptions of aerolite fell in this district, that sent in a wooden box (of which but a small fragment was found) fell at Bowarna, and that resembling granite or limestone fell at the places named, in much larger quantities.

24. The largest piece that was found of the latter weighed about four maunds pucka.

25. As the piece I have examined will not answer to the test of acetic acid, I am of opinion that it does not contain carbonate of lime. I should be glad to ascertain the exact chemical constitution, for I am firmly of opinion that it differs from all other stones or metals of terrestrial origin.†

26. The accompanying extracts of the more remarkable phenomena may be read with some interest by the Hon'ble the Lieutenant-Governor.

*Copy of a letter from Officiating Deputy Commissioner of Dhurmsalla, to R. H. Davies, Esquire, Secretary to the Government of Punjab, No.* 512, *dated* 25*th April,* 1861.

With reference to your letter No. 683, dated 4th instant, I have the honor to state that I have been making further enquiries with regard to the meteorolite that fell at Dhurmsalla.

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* It will of course be understood by all readers that the so-called showers of blood, the occurrence of which has been frequently recorded, consist of rain discolored by the mixture of a red substance.—*Ed. C. J.*

† *P. S.*—Probably there are grains of chrysolite in it, and perhaps cobalt or chrome as well, but I have no means of ascertaining this. It certainly is not magnetic, but it may be chromic iron.

2. Nó fresh information can however be obtained beyond that contained in my No. 927, dated 30th July, to the address of the Punjab Government

3. I beg to append a copy of a letter received from Monsr. Haidinger, Director General of the Imperial Geological Institute of Austria, dated Vienna, 14th November, 1860, on the subject of these meteoric stones.

4. In reply to this letter I forwarded a copy in extenso of my account of the fall of Aerolite referred to above, and begged the favour of their furnishing copies to each of the Institutions for which specimens were requested

5. I packed a box with 14 specimens of the Aerolite, and despatched this to the Private Secretary of His Excellency the Governor General, with a request that he would, after taking out certain specimens which were intended for His Excellency the Governor General, forward the box to Vienna in the manner directed.

6. One of the specimens was, as will be observed from the letter, intended for the British Museum.

7. I have, however, now sent the only remaining two specimens* I could procure to Lahore for transmission to the Secretary of State for India, either for presentation to the British Museum, or the Museum attached to the late India House, or for the acceptance of Her Most Gracious Majesty Queen Victoria.

8. The specimen now sent is the largest of any that has been despatched from Dhurmsalla, and being beyond the weight authorized for banghy parcels, I was under the necessity of forwarding it to Jullunder by coolies, and thence by Government Bullock-train to Lahore.

9. When worked up into handles for walking sticks or riding whips, the metallic substance is clearly visible.

10. As to the precise form of the Aerolite no positive information could be obtained, for it was found in fragments, and its intense coldness has been mentioned in the report before submitted.

11. The original of the letter from Vienna, together with a printed paper giving the falls of former Meteorolites, and an account of them

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* No. 1, of the fragment that fell at Bowarna. No. 2, of the large stone that fell at Dhurmsalla.

has been already forwarded to His Excellency the Governor General of India.

12. The specimens for Lahore have been forwarded under separate covers.

# REVIEWS.

*A Sketch of an Overland Route to British Columbia.* By Henry Youle Hind, M.A., F.R.G.S., Professor of Chemistry and Geology in the University of Trinity College, Toronto. Toronto: W. C. Chewett & Co. 1862.

Professor Hind has here brought together, from his own previous writings and personal knowledge of the country, and from the best authorities relating to that portion which lies beyond the limits of his own travels, an amount of useful information scarcely to be obtained elsewhere, and of the greatest importance to emigrants who are inclined to prefer the overland route. He has chosen what is really valuable, and given it in the most concise form, thus making his work at once portable and generally accessible. To the matter furnished by Professor Hind is added a letter of five and thirty pages, addressed to the author at his request, by Sandford Fleming, Esq., C.E., Engineer to the Northern Railway of Canada, containing "Practical Observations on the Construction of a Continuous Line of Railway from Canada to the Pacific Ocean, on British Territory." This is a subject of peculiar interest. It may seem to be specially pressed upon our attention at the present moment by the wants of emigrants seeking the Columbian gold regions, but its interest is really far higher in connection with the future course of an important part of the world's commerce, and with the settlement of a vast fertile region lying in the interior along and for some distance about the proposed line. Already the Red River settlement is becoming well known, and exciting no small attention. Its future is indeed not only most important to its inhabitants, present and prospective, but is eminently important to Canada and to the whole British Empire. It is so because the colony is sure to extend and increase in wealth, in products, and in wants; it is so also because upon it depends the continuity of the British Empire in North America, the communication within our own dominions between the Atlantic coast and the important and rapidly rising colony of British Columbia, and the prospect of a future intercourse, by the same route, with Japan, China, Australia, and India. If a good road from Canada to Rupert's Land is not speedily opened who can tell the effect on the minds of the inhabitants of seeming neglect on the part of the mother country and the great and advanced intervening colony, joined with habitual dependence on the United States for means of intercourse with the outer world and for all which they most want? We have no enmity against the United States. We admire much in their institutions, though, very naturally, we do not like them so much as our own. We esteem their people highly as friendly neighbours, and when some among them abuse and threaten us, we give the great majority credit for more just and reasonable sentiments. But there are those in the States who are ambitious of territorial extension, and who would not only offer to, but force upon others the institutions they themselves value, and if the affections of our countrymen were cooled by supposed neglect, or their interests be involved in a change of allegiance, it is not difficult to foresee that influences might be brought to bear upon them which we are convinced would not really favour their own welfare and progress, and which would most seriously affect the prosperity of the great empire of which the ignorant and thoughtless might account them an insignificant part. With these views, we cannot but feel how much is involved in the question of a practicable and not too difficult route from Canada to the Red River and thence to British Columbia, and accordingly we looked to the opinions of an experienced and able engineer like Mr. Fleming with more than curiosity. We were not surprised to find Mr. Fleming begin by pointing out the impossibility of proceeding at once with the construction of the great railway line, which he justly regards as the only really satisfactory means of communication across the continent. As this decision may cause disappointment to many, and might possibly lessen the public interest in what may be speedily accomplished, we first give our author's statement of the magnitude and cost of an undertaking, the importance of which he estimates so highly, that we cannot suppose any attempt to frighten us by an exaggeration of the difficulties:—

"Having determined the character of the means of communication most desirable to be established, it may be well now to glance at the comparative dimensions of the proposed work, and to consider the cost of its construction, as well as the annual expense of maintaining it for ever afterwards.

"Measuring on the map along the general route of the proposed line from the mouth of Frazer's River, through one of the best passes yet discovered in the Rocky Mountains, along the general direction of 'the Fertile Belt,' keeping south of the North Saskatchewan, crossing the Red River near the settlement, bridging the Winnipeg River at the north end of the Lake of the Woods, striking through the country to the most northerly bend of the shore of Lake Superior, thence in a direct line to a crossing on the French River west of Lake Nipissing, and from this point connecting with the existing railway system of Canada, either at the Town of Barrie, or at Peterboro, or at the City of Ottawa. The distance thus measured will be found to be in round numbers about 2000 miles; and although a railway between the two oceans on British territory cannot be considered perfect without the completion of the road between Halifax and the most easterly extension of the Grand Trunk in Lower Canada, yet as there is some prospect of this section being made independently, it does not appear necessary to embrace its length in the present consideration.

"That a just conception may be formed of the real magnitude of the project under discussion, and the means necessary to its attainment, attention may for a moment be drawn to a few leading details. The construction of 2000 miles of railway, measured by the average standard of similar works existing in this country, implies the performance of labourers' work sufficient to give employment to 1000 men for fifty or sixty years; it involves the delivery of 5,000,000 cross-ties or sleepers, and over 200,000 tons of iron rails for the 'permanent way;' it comprises the erection of 60,000 poles, hung with 1000 tons of wire, for the telegraph; it necessitates the creation of motive power equivalent to over 50,000 horses, which power would be concentrated in 400 locomotives; it involves the production of from 5000 to 6000 cars of all kinds, which, coupled with the locomotives, would make a single train over thirty miles in length; and lastly, it implies a gross expenditure on construction and equipment of not less than $100,000,000.*

"It will likewise serve as a salutary check on hasty conclusions, to weigh beforehand the cost of operating a truly gigantic establishment of the kind after its perfect completion. A few figures derived from actual results will shew that the first construction of a railway through the interior of British North America is even a less formidable undertaking than that of keeping it afterwards open, in the present condition of the country. For operating the line successfully, the fuel alone required in each year, and estimated as wood, would considerably exceed 200,000 cords; for keeping the road in repair, a regiment of 2000 trackmen would constantly be employed, in small gangs, throughout its

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"* Major Carmichael-Smyth estimated the cost of building a line of railway from Halifax to the Pacific at £150,000,000 sterling,—equal to over $700,000,000; but then he computes the expenditure as on English railways, where more money has been wasted in preliminary expenses, and lavished on architectural monuments at stations, than would suffice to build an equal length of road in this or any new country."

entire length. For the same purpose there would on an average be annually required 600,000 new cross-ties, as well as nearly 30,000 tons of new or re-rolled iron rails. The annual repairs of rolling-stock would not cost less than $1,000,000. Over 5000 employées of all kinds would constantly be under pay; and as these men would usually represent each a family, there would not be far short of 20,000 souls subsisting by the operation of the road. The aggregate amount of wages in each year, after the road was in operation, would swell out to nearly $2,000,000; while the gross expenditure for operating and maintaining works would annually exceed $8,000,000.

"Again, if to this last sum be added the interest on first cost, it becomes evident that until the gross earnings of the railway in each year come up to the enormous sum of $14,000,000, it could not pay interest on the capital invested."

Formidable as this statement may appear, and strongly as it brings home to us the absurdity of an immediate attempt by Provincial or even Imperial funds, and still more obviously by private enterprise, which for a considerable time could obtain no return, to carry out such plans, we think it may be well established that without any impracticable or pernicious expenditure a portion of the advantages sought—well worth great exertions to obtain—may be secured within a very moderate time, and (which deserves special attention) that the immediate benefit thus gained is not derived from a mere temporary substitute for what alone can fully satisfy our wishes, but results from preparations for and progress towards the grand scheme which should ever be kept in view as essential for our national development.

Mr. Fleming's peculiar idea, and it is one which deserves much consideration, is that whilst vast works must necessarily be carried on gradually and completed as the several parts can be brought into profitable use, it is possible and most desirable in opening a new country to employ skill and foresight in determining the best positions for the main thoroughfares and giving them the direction which must ultimately be most advantageous. When a new country is gradually occupied without order or preparation, under the guidance only of individual fancy, roads as they come to be formed will represent the nearest available paths from one point to another, where a few people have collected together. Where the settlement of a country proceeds under the control of a government, the land is generally divided into suitable portions or lots, which are given or sold to settlers, road allowances being left according to a definite plan. This plan, in order to save expense and trouble, is a formal one, producing equal sized lots bounded by straight lines independent of the natural features of the country, with roads left at regular intervals which may be improved as they are wanted, but which are liable to pass through swamps or over steep hills and which have no reference to any particular place to be reached by them. Mr. Fleming contends that in laying out for occupation a country which is as yet a wilderness, it is of great importance to consider well the natural features of the country, the parts best fitted for immediate occupation and its relations with other neighbouring or connected countries, and to open roads and lay out lots in reference to these circumstances. He divides the roads required into three classes—the great leading roads, which ought to become railways, and which he would call "Territorial Roads;" the gravel or stone road, going through important parts of the country, and around which the first settlements would be made, which he proposes to name "Colonization Roads;" and the earth roads, formed by a mere clearing of the forest, offering access to farms, but not needing any special efforts for their improvement, which may be denominated "Concession Roads." The following extract shews how these several kinds of roads should be formed:—

"In pre-arranging a system of internal communications for a new territory, it would be necessary to take a prospective view of the character of the traffic which might exist when, after a lapse of years, the district becomes populated. In this we might be guided by drawing a comparison between the natural advantages of soil, climate, and position of the section of the country to be colonized, with those of any similar section which has become occupied, and, to to some extent, developed. In this manner we could form some idea of the nature of the future commerce of the country, and consequently of all the classes of roads which would ultimately be required to accommodate it. The leading direction which traffic may seek, or the direction which, in a national or political sense, it may appear expedient to guide it, would prescribe the general direction of the main line of road through the territory, and the other consideration would determine its character. This is the first thing to be established, as upon it the direction and character of all minor lines mainly depend.

"Assuming the tract of country to be colonized is such as to justify us in the belief that in due time a railway may be constructed through it, the first step would be to lay out a 'Territorial Road' between the more important points in the general direction of traffic previously determined. The territorial road ought to be located with the utmost care, and in all that relates to curvatures and levels, the best railway location in an *engineering aspect alone* which the country traversed could afford. In this respect there would doubtless be less than usual difficulty, as there would be neither right-of-way obstacles to guard against nor local interests to serve, and consequently no undue influences to twist or warp the intended line out of the most advantageous location. The main artery of traffic for the future service of the country might thus be determined upon under the most favourable circumstances.

"It would next be necessary to select, at proper intervals, the most suitable points for stations and villages; and from these, as diverging points, 'Colonization Roads' might then be laid out to the right and left, with as much care as the location of gravel or macadamized roads generally requires. These colonization roads thus laid out and adapted to the peculiar features of the locality, avoiding steep hills, ravines, lakes, or unnecessary river crossings, might form centre or governing lines upon which the townships may be projected; these townships to be sub-divided in the usual way into blocks of farm lots, with concession roads between, drawn so as to unite with the colonization roads."

Mr. Fleming having made a calculation as to the amount of timber required for fuel and repairs in a country where, for some time at least, wood must be looked to as the main supply of fuel, proposes as the easiest plan to reserve a sufficient space on each side of the territorial road for the necessary supplies, and this, he ingeniously contends, would in a great degree guard the railway, which is as speedily as possible to occupy the territorial road, from the evil of snow drifts. He points out other advantages arising from this kind of reserve along the line of road, and shows that, the principal stations being chosen with reference to fitness for settlement, and made the centres of colonization roads, around which the blocks for farming purposes, with concession roads giving access to them, would be laid out, no serious inconvenience could arise from the sides of the territorial road not being immediately occupied. It remains for us to give in his own words, Mr. Fleming's ideas as to the modes in which the work of forming a highway to the Pacific should be carried forward, and the time which may be expected to be required for its completion; the latter, of course, depending much on the number of settlers that can be introduced into a country which, independently of its own great advantages, will by means of this work afford them great assistance in overcoming the first difficulties of a new settlement. The following is our author's summary of the points he has endeavoured to establish:—

"1st. That the project of a highway to the Pacific is as old as the first settlement in Canada, and that recent events show its increasing importance.

"2nd. That a continuous line of railway, with electric telegraph, is better calculated to meet the permanent wants of the country and serve the interests of the colonial empire, than any other means of communication between the two oceans.

"3rd. That although the magnitude of the scheme for a railway across the Continent is very great, yet the vast importance of the work,—in a commercial, military, and national view,—would demand its construction were the resources of the country and the traffic sufficiently developed.

"4th. That the immediate completion of this work cannot be seriously entertained in the present condition of the country, the cost of maintenance, without sufficient traffic, being so very great; and that therefore, to be constructed at all, the railway must be a work of time.

"5th. That the Canadian road and railway system has illustrated the advantages which may be derived from the adoption of a comprehensive road scheme in laying open new districts for settlement.

"6th. That a scheme which embraces the ultimate completion of railways and less perfect lines of communication, by a progressive system of construction, possesses many features favourable to the first settlement as well as the future requirements of the traffic of new territories.

"7th. That the system proposed for the development of the highways of a new country, by progressive stages corresponding with the progress made by the country itself in general advancement, is one peculiarly applicable to the case under discussion; and while it might be expedient, in the first instance, to employ some of the natural water channels as a means of introducing settlers and labourers along the line of road, until the latter became in some degree serviceable, it would not be advisable to incur any great expenditure on works beyond the limits of the great thoroughfare ultimately in view. That the first effort should be made to construct an electric telegraph along the precise line of the future railway; that the telegraph should be the precursor of other means of communication, beginning, it may be, with a bridle path or Indian trail from post to post, and ending with a perfect line of railway when the traffic of the country or the interests of the nation required the most rapid means of steam communication."

We select also a few paragraphs respecting the mode of proceeding with the work:—

"The first step required is the location of what has been designated a 'territorial road' between all the more important or governing points on the line of route. Commencing at the western terminus, these points would probably be: the mouth of the Frazer River, or the best harbour on the Pacific coast north of the 49th parallel; the best pass which has been or may be discovered across the Rocky Mountains contiguous to a line which would run along the general direction of the 'Fertile Belt' of the interior; the most southerly bend of the North Saskatchewan River; the best crossing of Red River between its confluence with the Assiniboine and the southerly end of Lake Winnipeg; the best crossing of the River Winnipeg near the north end of the Lake of the Woods; the most northerly bend of the shore of Lake Superior; the best crossing of the French

River between its junction with Lake Huron and Lake Nippissing; and, lastly, the most desirable point of connection with the existing railway system of Canada, either at Ottawa, at Peterboro, or at Barrie—all of which points are directly connected with the Grand Trunk Railway by means of the branch lines running southerly to it. On the location of the 'territorial road,' which could only be done on a careful survey of the country, the next step would be the determination of station points from whence to lay out colonization roads to the right and left, wherever the soil was favourable for setttlement. Upon the colonization roads the townships would next be projected.

"So soon as any section of the road was finally located, together with its branches, the introduction of settlers might commence. The road should be cleared through the wooded districts to a width of two chains, or 150 feet, in order chiefly to preserve the telegraph when erected from being injured by trees falling. The clearing would at once give employment to settlers, and with subsequent work in improving the road, greatly aid them in paying for their land and in supporting their families until their farms produced sufficient crops. Throughout the open prairie country, which is more than one-third the whole distance, the trouble and expense of clearing would be avoided; but as the great natural obstacles which isolate the interior, and prevent the possibility of establishing a continuous telegraphic communication through the country, are the wooded and broken districts at both extremities, it becomes indispensable to force a way of communication through them. This is doubtless a work of considerable labour and corresponding expenditure, but without it no satisfactory progress can be made. This preliminary step is especially requisite to the east of the Red River valley, so that settlers might obtain access to the central plains; and in view of the construction of a continuous line of telegraph at an early day, to be followed by a waggon-road as soon as circumstances would allow, the 'territorial line' should be cleared through the western division likewise."

"To begin at one end of the road, and gradually extend the settlements northward and westward, would perhaps be too tedious an operation, in view of the importance of opening an early connection with the interior. It would, therefore, doubtless be advisable to begin at several intermediate points accessible by water from Lakes Huron and Superior, and proceed with simultaneous operations. On referring to the map, it appears that such points exist at distances ranging from 50 miles to 90 miles apart; and from these, as bases, the clearing of the road could proceed in both directions at the same time, while settlements could be formed wherever the soil proved favourable. In due time the clearings, penetrating the forest to the right and left along the line of road previously located, would pierce the country from one end to the other; and the same being accomplished in a similar manner in the western division, a continuous line of electric telegraph might then be constructed.

"The extreme importance of the telegraphic communication extending from colony to colony across the country, even during the earliest stages of settlement, is too apparent to need comment; and being constructed on the precise line of the intended waggon-road and of the ultimate railway, it would always be in the position where its services would be called into requisition.

"While the territorial line through the eastern division gradually became developed into a good waggon-road, by the labour of the settlers and such grants of money as its importance appeared to warrant, it is probable that the canoe routes from Lake Superior to Red River might, by partial improvement, be made serviceable for ingress and egress during summer to the interior; and with the object of promoting emigration to the central plains, as well as to other points along the line of road, it would probably be expedient to improve these routes by a limited outlay; but, for the reasons I have already given, I cannot help thinking that it would be the wisest policy to concentrate the chief expenditure on that line which must be, sooner or later, the leading highway through the country."

In order to give an idea of the time required, we add the following extract, not without observing that the annual emigration here supposed is greater than, for some time at least, could at all be expected:—

"It has already been shown that the success of a railway to the Pacific would mainly depend on the possibility of introducing a sufficient number of inhabitants into the country to be traversed. If the population of the country is to govern the period when a railway is to be set in operation, we may likewise take it as the basis of annual expenditure on the preliminary stages of the work. Suppose the average annual increase could be reckoned at 100,000 souls, and that it be determined to expend annually on the works a sum equal to one dollar per head of the whole population in each respective year, the following results in the development of the undertaking might be obtained:

"1st. In from three to four years, besides the expense of surveys, a territorial road line might be located throughout; the wooded districts, which extend over a length of over 1,400 miles, might be cleared to a width of two chains, and a continuous line of telegraph constructed from Canada to Frazer's River.

"2nd. Within a further period of two years, a road passable for wheeled vehicles might be formed along the whole line of route.

"3rd. Macadamized roads of the very best description might be completed in addition to the foregoing, in the following order:

"(1) From Lake Superior to Red River, a distance of 400 miles, in nine years from the present time.

"(2) From the mouth of Frazer's River to the Rocky Mountains, a distance of 400 miles, in eleven years from the present time.

"(3) From the settlements of Canada to Lake Superior, a distance of 650 miles, within fourteen years from the present time.

"(4) From Red River to the Rocky Mountains, a distance of 800 miles, within seventeen years from the present time.

"And thus, by the comparatively trifling annual outlay of one dollar per head of the assumed gradually increasing population, we could secure, in less than four years, a line of telegraph; and in thirteen years more, a substantially constructed macadamized road throughout the whole length of the line. The next and final stage of progress would be the completion of the railway on the line thus in a great measure prepared for it; and in view of the traffic then created, as well as the comparative economy in construction, it might be undertaken in sections by private enterprise, or in such other way as might then appear most expedient.

"I am not prepared to say that the foregoing is the best order of sequence in which the several sections and stages of the work should be constructed; it is simply presented for the purpose of showing what might be accomplished by a small annual expenditure. It is not at all unlikely that the peculiar nature of the traffic might warrant the conversion of some section of route into a railway at an early period; possibly that section between Lake Superior and Red River would be the first to require the change, which of course could be made without difficulty at any time, so soon as it appeared that the trade of the country was sufficient to maintain it. The order of sequence is not important; but it is an essential part of the system proposed for opening up this vast and roadless country, that every portion of work done should form a component part of a perfect whole, and that whatever expenditure is made,—whether it be one thousand or one hundred thousand dollars,—should be laid out in the right place, in accordance with a thoroughly digested and well matured plan, the great object in view being to obtain the maximum result of good from the minimum amount of outlay."

We have no hesitation in ascribing to Mr. Fleming's letter a high degree of practical importance, and considering it as greatly increasing the value of Professor Hind's very useful work. We recommend not intending emigrants only, who would like in seeking the Gold Mines to take the most direct route, and who think it prudent to train themselves for their proposed work by the labours and hardships of their journey, but thinking men and patriots generally to study this little book, and consider how far it is fitted to guide their efforts in a great and noble national enterprise. We confess to a feeling of impatience at finding that more speedy action seems hardly possible; yet we know that this is a weakness, and if we could only see our way to the speedy attainment of a good communication between Canada and the Red River Settlement by such improvement of the canoe line as should make it really available for commercial purposes, together with a commencement at laying out the grand roadway, and promoting settlements at suitable stations, we could be content to leave the work to those who come after us, confident that the accumulating proofs of its importance would prevent any danger of its being abandoned, and that it must, in due time, contribute its full share to the glory and prosperity of Canada and the British Empire.

W. H.

LAST POEMS, *by Elizabeth Barrett Browning, with a Memorial, by Theodore Tilton.* New York: James Miller. 1862.

An American reprint of the sad memorial of England's greatest poetess makes its appearance under this title; and the interests of English survivors in the rights of her last gift of song, are thus committed, by Robert Browning, her widowed heir, to the invoked courtesy of those with whom the pirating of English authorship is their bread of life:—"The right of publishing this book in the United States having been liberally purchased by Mr. James Miller, it is hoped that there will be no interference with the same." The very title of the volume: "Last Poems," is full of tenderest pathos, which repeats itself in "The Last Translation," and the "Last Poem." This last poem tells of the home of the songstress's latest dreams and aspirations. Its theme is "*The North and the South*," and the poet exclaims:—

"Oh for the skies that are softer and higher!"
    Sighed the North to the South;
"For the flowers that blaze, and the trees that aspire,
And the insects made of a song or a fire!"
    Sighed the North to the South.

"And oh, for a seer to discern the same!"
    Sighed the South to the North;
"For a poet's tongue of baptismal flame,
To call the tree or the flower by its name!"
    Sighed the South to the North.

The North sent therefore a man of men
    As a grace to the South:——

And who was he? Abraham Lincoln perhaps; or "the Young Napoleon;" or as the special Grace, the man of men sent by the North to the South, shall we guess the chivalrous General Butler?—It is in Rome, not Washington, that the poet penned her latest poem; it is Florence and Naples,—not New York and New Orleans,—that exchange their greetings in her song, in words fitter for a united Italy than for the New World States now seeking for lost brotherhood by fire and sword, as they again exclaim:—

"Give strenuous souls for belief and prayer,"
    Said the South to the North,

"That stand in the dark on the lowest stair,
While affirming of God, 'He is certainly there,'"
Said the South to the North.

It is with Italy in its aspirations for unity and freedom that all the poet's later thoughts were. It was there that her wedded life was past, with her strong, vigorous, if not seldom roughly felicitous poet-husband, Robert Browning. There her Tuscan boy, the son of so illustrious a lineage, saw the light, under sunnier skies than England knows: though England will not the less lovingly watch the future of this child of hope. It is a pleasant story told of the Italian street-beggars who walk through Via Maggio under the windows of Casa Guidi, that they always spoke of our English poetess, while living in that house, the name of which she has linked with her prophetic song, not by her well-known English name, nor by any softer Italaian word, but simply and touchingly as "the mother of the beautiful child." This, as Tilton says, was pleasanter to that woman's ears than to

Hear the nations praising her far off.

Elizabeth Barrett, as is well known to every reader of her earlier verse, was a delicate, fragile, invalid, with a keenly sensitive poetic temperament, strung to acuter intensity of feeling by physical suffering; and this gives a certain tinge to all her verse. In her "Vision of the Poets," she beholds the

Poets true
Who died for beauty, as martyrs do
For truth—the ends being scarcely two;

and a favourite sentiment of Shelley's reappears in many forms in her verse, that poets

learn in suffering
What they teach in song.

To her dog Flush, after contrasting the sportive graces of others of his race, she exclaims:—

But of thee it shall be said,
This dog watched beside a bed
Day and night unweary,—
Watched within a curtained room,
Where no sunbeam brake the gloom
Round the sick and dreary.

And again, tenderly and touchingly, in her "Sleeping and Watching," she apostrophises the child just fallen asleep with his playthings in his tiny hands:—

And God knows, who sees us twain,
Child at childish leisure,
I am near as tired of pain,
As you seem of pleasure.

This union of the suffering woman and the agonising poet-seer, gives a tone to all her verse; and though her fond aspirations were mingled with brighter anticipations in her Italian sympathies, when the happy wife and mother looked forth from a sunny present into a more hopeful future, yet her latest Italian poems still thrill from the same treble chord; and she seems ever to have felt what finds expression in one of her latest snatches, where she asks and answers:—

What's the best thing in the world?
—Something out of it, I think.

In "The Forced Recruit," the poetess sings in sad tenderness of the nameless Venetian conscript forced into the Austrian ranks, and perishing by his own Italian brothers' hands at Solferino, his unloaded musket dropping from his dead grasp: and all the mother and the poet blend in the verses she puts into the mouth of Laura Savio, of Turin, an Italian poetess and patriot, whose two sons perished at Ancona and Gæta. It is from such mingling elements of the woman and the poet that we trace the vein of thought which runs through the following fine allegory of the making of such a songstress:—

"A MUSICAL INSTRUMENT.

"What was he doing, the great god Pan,
Down in the reeds by the river?
Spreading ruin and scattering ban,
Splashing and paddling with hoofs of a goat,
And breaking the golden lilies afloat
With the dragon-fly on the river.

"He tore out a reed, the great god Pan,
From the deep cool bed of the river:
The limpid water turbidly ran,
And the broken lilies a-dying lay,
And the dragon-fly had fled away,
Ere he brought it out of the river.

"High on the shore sat the great god Pan,
While turbidly flowed the river;
And hacked and hewed, as a great god can,
With his hard bleak steel at the patient reed,
Till there was not a sign of a leaf indeed
To prove it fresh from the river.

"He cut it short, did the great god Pan,
(How tall it stood in the river!)
Then drew the pith, like the heart of a man,
Steadily from the outside ring,
And notched the poor, dry, empty thing
In holes, as he sate by the river.

"'This is the way, laughed the great god Pan,
(Laughed while he sat by the river),
The only way, since gods began
To make sweet music, they could succeed.'
Then, dropping his mouth to a hole in the reed,
He blew in power by the river.

"Sweet, sweet, sweet, O Pan!
Piercing sweet by the river!
Blinding sweet, O great god Pan!
The sun on the hill forgot to die,
And the lilies revived, and the dragon-fly
Came back to dream on the river.

"Yet half a beast is the great god Pan,
To laugh as he sits by the river,
Making a poet out of a man:
The true gods sigh for the cost and pain,
For the reed which grows never more again
As a reed with the reeds in the river."

For fourteen years our tender yet masculine English poetess has dwelt by the banks of the Arno, under bluer, sunnier skies than smile above her earlier English home. From Casa Guidi's Florentine windows she looked forth on a new world; and from Casa Guidi's portal she has at length been borne forth to her grave: another English poet to mingle her ashes with the classic soil, which Chaucer and Milton trod; where Byron lingered, and the veteran Landor still courts the shade under southern vines; where the graves of Keats and Shelley give repose to the once o'erburdened tenements of clay; and where Robert Browning, the strange, vigorous poet of "Men and Women," has found himself more at home, than in the land to which he turned for his poet-bride, and for which still he writes in mother tongue his English verse. D. W.

*A Manual of Botanic Terms.* By M. C. Cooke, author of "A Manual of Structural Botany," &c. London: Robert Hardwicke, 192, Piccadilly.

We can see the utility of a complete dictionary of botanical terms, which should explain as to its meaning and derivation every term employed by every writer deserving of notice, and should at the same time attempt to pronounce judgment as to the necessity of each, its fitness for its purpose, and the proper selection to be made amongst equivalent terms; but we can hardly admit the usefulness of such a work as that before us, all terms—the understanding of which is required for ordinary purposes—being explained in nearly every introductory botanical book; and the most natural effect of such an attempt as our author's being to bring before beginners in the study, to their no small discouragement, a mass of needless (often repulsive) terms which would, with great benefit to science, be consigned to oblivion.

Mr. Cooke considers his manual as fitted for the use of such of the operative classes as are cultivating the study of botany. Certainly he has avoided frightening those who have not had a classical education by the sight of Greek letters, having printed his Greek words in English characters, which may be a small assistance to some; but he has made no attempt to simplify the terminology, and we take the mere bringing together in an elementary work of so many harsh and useless terms, to be no small evil. We observe instances in which the explanations given are erroneous or unsatisfactory, as where *actinenchyma* (a needless term) is said to mean "the cellular tissue of medullary rays," to which it would be improperly applied,—the true meaning, "stellate cellular tissue" being added as if equivalent; and *pistil*, of which the explanation given, "the female organ of flowering plants," is utterly vague; and again, *Gynoecium*, which is said to mean "the pistil and its appendages." We refer to *carpel*, and find it explained, "one of the modified leaves composing a pistil." Differing from some recent authorities, we hold it to be very certain that Linnæus did not employ *pistil* as a general term for all the parts (modified leaves) which form the inner circle of the flower, and are called female organs; but either not recognizing, or not thinking it necessary to notice, the composite character of a syncarpous fruit, he equally called the whole of such fruit, and the separate carpels of the apocarpous fruit, pistils; in case of partial coherence counting one or several pistils, accordingly as the styles were separate or combined. With this view, we conclude that the term "pistil" should now only be used in connection with the Linnæan artificial system. Gynoecium we take to be the proper collective term for the whole of the carpels, one or many, as the case may be,—just as corolla expresses the whole of the petals, and androecium the whole of the stamens; but we believe no correct botanical writer would employ gynoecium to include any part occasionally connected with the carpels, but really not belonging to their circle; nor is it correct to describe a carpel as part of a pistil, which so often means a single carpel: it should have been explained, "one of the modified leaves composing the gynoecium;" or better, perhaps, "an organ formed from a modified leaf in the interior of a flower, of which the lower portion is ovuliferous, the middle portion (when distinctly present called the *style*), serves to elevate the glandular extremity, called the *stigma*, through which the pollen acts upon the ovules."

The useless terms which Mr. Cooke has preserved are in our opinion very numerous. Thus we take from the few first pages, *alabastrus*, *amphisarca*, *angienchyma*, *anthocarpous*, *anthodium*, *atractenchyma*. What these words mean could be better expressed in plain ordinary English. They are only a burden to the science; and it is doing an injury to press them on the attention of ordinary students, amongst whom may be found those who will think it a sign of knowledge and skill to use them.

Mr. Cooke's book is prettily got up, and the illustrations are good and useful of their kind; but we cannot say that we think it judicious, or that it supplies a real want of any class of students. We cannot, therefore, bestow upon it any strong recommendation.

W. H.

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*Descriptive Catalogue of a Collection of the Economic Minerals of Canada, and of its Crystalline Rocks.* Sent to the London International Exhibition for 1862.

This catalogue is an admirable work, not merely serving the purpose of a guide of the most useful kind to the collection in the exhibition, but being also a most convenient permanent record of the economic minerals of Canada, and the principal and best known stations in which they occur. The arrangement has reference to the uses of the objects, and is exceedingly well-fitted to enable practical men to ascertain where what they may want is to be found. The following are the heads under which the mineral products are arranged; and the notes, of which we shall give a specimen or two, give information scientific as well as practical, useful, and precisely of the kind, we should suppose, which would be found most valuable.

1. Metals and their Ores.
2. Minerals applicable to Chemical Manufactures.
3. Refractory Minerals (for resisting fire).
4. Minerals applicable to Common and Decorative Construction.
5. Grinding and Polishing Minerals.
6. Mineral Manures.
7. Mineral Paints.
8. Minerals applicable to the Fine Arts.
9. Minerals applicable to Jewellery.
10. Miscellaneous Minerals.

The following is the note on the Bruce mines, Lake Huron:—

" 2. Bruce Mines, Lake Huron.............*Montreal Mining Co., Montreal.*
" *a.* Yellow and variegated sulphuretes of copper, from the lode.
" *b.* " " " rough dressed.
" *c.* " " " jigged.
" *d.* Rough waste from jigging on copper bottom sleeves.
" *e.* Plans of the mine, by Mr. C. H. Davie.

" At the Bruce mines, a group of lodes traverses the location in a northwestward direction, intersecting a thick mass of interstratified greenstone trap. The strata here present an anticlinal form, the lodes running along the crown of it. All of the lodes contain more or less copper ore, which is disseminated in a gangue of quartz. The main lode, which is worked with another of about the same thickness, is, on an average, from two to four feet wide. In a careful examination made in 1848, about 3000 square fathoms of these lodes were computed to contain about 6½ per cent. of copper. The quantity of ore obtained from the mine, since its opening in 1847, is stated to be about 9000 tons of eighteen per cent. The quantity obtained in 1861 was 472 tons of seventeen per cent. The deepest working is fifty fathoms from the surface. The number of men employed is thirty-four. Smelting furnaces, on the reverberatory principle, were erected at the mine in 1853; the fuel used in these was bituminous coal imported from Cleveland; but after a trial of three years, the Company themselves ceased smelting, and subsequently leased their smelting works to Mr. H. R. Fletcher. At present, the ores are in part sent to the Baltimore market, and in part to the United Kingdom.—*Huronian.*"

We next give a few notes on marbles, a subject of great and increasing interest:—

" 1. Arnprior.......... ......................... *Geological Survey.*

" *a.* Striped light and dark grey marble, large pattern.
" *b.* " " " " small patern.
" *c.* " " " " cut across the beds.

" At the mouth of the Madawaska, in McNab, a great extent of crystalline limestone is marked by grey bands, sometimes narrower, and sometimes wider, running in the direction of the original bedding, and producing, where there are no corrugations in the layers, a regularly barred or striped pattern. When the beds are wrinkled, there results a pattern something like that of a curly grained wood. The colours are various shades of dark and light grey, intermingled with white. These arise from a greater or less amount of graphite, which is intimately mixed with the limestone. The granular texture of the stone is somewhat coarse, but it takes a good polish, and gives a pleasing marble. Mr. W. Knowles has opened a quarry in limestone of this description at Arnprior, and erected a mill for the purpose of sawing and polishing it for chimney pieces, monuments and other objects. A monument of it has been erected in the Mount Royal cemetery.—*Laurentian.*

" 5. St. Armand........................*C. R. Cheeseman, Phillipsburg.*

" *a.* White marble.
" *b.* White "
" *c.* White " clouded with pale green.
" *d.* Dove-grey marble, marked with white.

" The marbles, of which Mr. Cheeseman exhibits specimens, occur in great abundance in the immediate vicinity of Phillipsburg, on Lake Champlain. They are all easily cut, and take a good polish. Should a railway, which is projected between St. Johns and St. Albans, be carried into operation, it is probable there would be some demand for the stone. No quarries have been opened on any of the beds, and these specimens are taken from surfaces that have long been exposed to the influence of the weather.—*Quebec group, Lower Silurian.*

" 6. St. Armand..................... ............*Geological Survey.*

" *a.* Black marble.

" About a mile and-a-half south-eastward from Phillipsburgh, there occurs a black marble, similar to this specimen. The beds dip to the eastward at an angle of about twelve degrees ; a quarry was many years ago opened on one of them, which has a considerable thickness. The stone was exported to the United States, and much esteemed in New York, but the opening of quarries of black marble at Glen's Falls, where there is a great water-power, interfered with the demand, and caused the enterprise to be abandoned.—*Quebec group, Lower Silurian.*"

Another most important product is roofing slate. What follows relates to the Walton Quarry. Specimens from other localities are exhibited by the geological survey.

"1. Walton Quarry, Melbourne, lot 22, range 6.... *Benjamin Walton, Montreal.*

"*a.* Specimens of roofing slate.

"This band of slate is in immediate contact with the summit of the serpentine. It has a breadth of one-third of a mile, and dips about S. E.<80°. Mr. Walton commenced opening a quarry upon it in 1860, and found it necessary, in order to gain access to the slate, to make a tunnel through a part of the serpentine. To complete this, and to expose a sufficient face in the slate to pursue profitable working, has required two years of time, and $30,000 of expenditure. The face now exposed has a height of seventy-five feet; but the band of slate crosses the St. Francis and the fall from the position where the quarry is now worked, to the level of the stream, is upwards of 400 feet, the distance being one and-a-half miles, so that by commencing an open cutting on the slate, at the level of the stream, a much greater exposure can be ultimately attained. Up to a comparatively recent period, the usual coverings of houses in Canada have been wooden shingles, galvanized iron or tin-plate, but so many destructive fires have occurred from the use of the first of these, that they are now interdicted in all large towns. Slate, as a covering, costs about one-third more than shingles, but one-half less than tin, and one-third less than galvanized iron.

"The quarry has now been in operation since the spring of 1861; 2000 squares have been sold, and some of the slates have been sent to a distance of 550 miles from the quarry; a quantity of them having been purchased for Sarnia on the River St. Clair. To show that slate, as a covering, is well adapted to resist the influences of a Canadian climate, it may be here stated that slates from Angers in France, have been exposed on the roof of the Seminary building on the corner of Notre Dame and St. François Xavier Streets, in Montreal, for upwards of 100 years, without any perceptible deterioration. The strong resemblance between these and the slates of Melbourne, as well as those from Bangor in Wales, may be seen in the following comparative analyses by Mr. T. Sterry Hunt:—

| | Welsh. | French. | Melbourne. |
|---|---|---|---|
| Silica .................. | 60.50 | 57.00 | 64.20 |
| Alumina.. ............. | 19.70 | 20.10 | 16.80 |
| Protoxyd of Iron....... | 7.83 | 10.98 | 4.23 |
| Lime.................. | 1.12 | 1.23 | 0.73 |
| Magnesia .............. | 2.20 | 3.39 | 3.94 |
| Potash ................ | 3.18 | 1.73 | 3.26 |
| Soda................... | 2.20 | 1.30 | 3.07 |
| Water.................. | 3.30 | 4.40 | 3.40 |
| | 100.03 | 100.13 | 99.63 |

The proximity of the serpentine leaves no doubt as to the geological horizon of these slates.—*Quebec Group, Lower Silurian.*

These quotations will sufficiently illustrate the character of the information afforded. Its extent and variety can only be understood by an examination of the work itself. The descriptive catalogue of a collection of the crystalline rocks of Canada is the work of T. Sterry Hunt, F.R.S. They are arranged as belonging—1st, to the Laurentian system; 2ndly, to the Huronian series; 3rdly, to the Silurian series; and 4thly, intrusive rocks—under each of which heads the particular substances are enumerated, with their localities and very valuable remarks. The whole work is a credit to the country, and a model in its class, as the fine collection of which it gives an account has secured universal admiration amidst the wonders of the Great Exhibition, and will direct the thoughts of many intelligent men to one portion of the varied riches of our country.

W. H.

# TRANSLATIONS AND SELECTED ARTICLES.

## RESEARCHES RESPECTING THE AFFINITIES OF STRUCTURE IN THE STEMS OF PLANTS BELONGING TO THE GROUP "CYCLOSPERMEÆ."

BY M. REGNAULT.

*Translated from "Annales des Sciences Naturalles,"* IV*eme Serie, Botanique, Tome* xiv. *No.* 2, *p.* 73.[*]

The knowledge of the principles upon which the classification of vegetables must be founded, obtained up to the close of the last century, has not merely led to a more methodical and more natural arrangement, but has given to all parts of the science a vigorous impulse, by clearly indicating the road which must be followed in further researches.

In truth, as the system was understood by its author, the natural classification of vegetables should be founded on the consideration of all the characters they furnish. Hence it might be justly said, that a perfect classification would in a manner represent the whole science, since it must have, as its indispensable foundation, a complete knowledge of the relations which unite plants one to another. Consequently, classification must connect itself with all the branches of botanical science. Organography, or the description of the external characters of the parts of plants, without doubt supplies it with the distinctive marks most easily determinable, and on that account most frequently employed; but Teratology [the description and explanation of abnormal developments], Organogeny [the account of the origin and earliest condition of organs], and Vegetable anatomy, should also come to its aid, and supply it with useful materials.*

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[*] Our translation includes only the introductory remarks of the learned author, which contain important general principles. His detailed observations, though highly interesting and valuable, our space will at present only permit us to refer to.

In 1810, at the commencement of the present century, Mirbel proclaimed anew this great principle, which seemed to have been already forgotten, in making an application of it to the study of the natural family of the Labiatæ [*Ord.* Lamiaceæ].

This botanist at that time thus expressed himself (*Annales du Museum d'Histoire Naturalle*, vol. xv.) : "The only means of perfecting our knowledge of natural families, is to unite with the study of botanical characters that of all anatomical and physiological facts. I have said that the importance of characters depends much less on their constancy than on the necessity of their co-existence. I have affirmed that the greater number of botanists, after having too long much neglected the organs of reproduction, have committed an error almost equally great, in pretending that these organs should alone furnish the principal bases of a natural classification."

We should, then, apply ourselves to gain a knowledge of vegetables at once, in every part of their organization: and on this view it may be truly said, that among the vast labours undertaken during the present century, by the eminent men who have devoted themselves to the study of plants, there is not one which does not directly assist classification; ; which, however, can never be absolutely perfect until we know all plants, or at least some types of each family, as well viewed in respect to the organogeny of the flower and fruit, and the anatomical structure, as in respect to a merely organographic description.

Science is as yet very far from having reached this result. Great labours have, however, been accomplished during the present century, and already they have borne their fruits. They have especially promoted the advancement of two branches of botany, which the imperfection of optical instruments had previously left in a great comparative inferiority: organogeny and anatomy. Researches in organogeny have been numerous and important. Pursued with ardour and perseverance by such botanists as Mirbel, Robert Brown, Payer, Hugo Mohl, Brongniart, Schleiden, and Duchartres, they have caused to be recognised much more clearly than before, the general symmetry of the flower; that is to say, the disposition in relation to each other of the different parts that compose it. They have given the key to a crowd of apparent anomalies, bringing back, for example, to the ordinary type of monocotyledonous vegetables, the flowers, at first view so singular, of the Canneæ [Marantaceæ and Zingiberacene] orchidaceæ, &c. They have shown the real resemblance of plants, which their strikingly different forms seemed to separate widely; and have confirmed, in a very great number of cases, divisions previously established by botanists, as well as justified modifications of a number of others, by exhibiting natural affinities more perfectly. And finally, they have completely justified the celebrated saying which Gœthe had placed at the head of his works: "*To see the origin of things is the best means of explaining them.*"

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* It would perhaps be more correct to regard Teratology and Organogeny as only auxiliary departments of Organography, assisting us to form a juster view of the real nature, origin, and position of certain parts.—*Translator.*

Anatomy ought also to afford precious assistance to natural classification. It is already very long since Mirbel expressed the opinion that the study of the comparative structure of vegetables might afford sufficient characters for limiting natural groups. He even believed that this truth might be generalised and applied to the vegetable kingdom as a whole. Such a conclusion was then, and would still be at this time, at least premature. Further researches can alone inform us to what extent we can rely on the constancy of anatomical characters, and on their value in respect to classification. Nevertheless we may well wonder, as M. Chatin expressed it in 1840 (*Appl. de l'anatomie Comp. Vegetale a la classification, these* 1840), "at the feeble progress made by vegetable comparative anatomy, and the small amount of utility hitherto derived from it in respect to natural arrangement; whilst in Zoology, anatomy serves as the solid basis of the labours of all classifiers."

However, if the degree of importance which ought to be attributed to comparative anatomy is not yet well settled, numerous researches on the subject already exist; and we may affirm, that hitherto nothing has occurred which tends to prove that the structure of vegetables has not a general correspondence with their natural affinities. Of this kind we find clear characters for the three great sub-kingdoms. In each of them the plants have an internal structure very different from that which belongs to the adjoining sub-kingdom, and are sufficiently distinguishable by their anatomical construction.

One of these sub-kingdoms, that which occupies the lowest place, has been examined with great care in reference to this matter. All inquiries have confirmed the principle of the importance of anatomy. It is by a character exclusively anatomical that the great group of the Acotyledones [flowerless plants, or Cryptogamia] has been divided into two secondary groups—Vascular and cellular plants.*

The importance of anatomy by no means appears less, if in each of these sub-divisions we examine the mutual relations of classes and families. The structure of the Horse-tails, Ferns, Lycopodiaceæ, and Marsiliaceæ, does not less certainly than characters drawn from their vegetation and reproduction distinguish these orders one from another.

The same may be said still more decisively of the entirely cellular plants whose extreme simplicity causes the essential characters upon which their most important groups are founded, to be often no more than anotomical characters, implying important modifications of organic functions.

In the sub-kingdom Monocotyledoneæ, it is a very long time since Daubenton and Desfontaines (*Memoires de l'Ist.* an vii.), as the result of numerous examinations of different palms, pointed out as common to the whole sub-kingdom, an anatomical disposition of parts alogether peculiar, and contrary to the internal structure of Dicotyledoneæ. According to these writers the stem of a woody Monocotyledonous plant is of less close texture towards its centre, because at that part are maintained constantly vegetation and the formation of new fibres [vascular bundles], which push outwards continually the previously existing fibres, "hence these latter are at length so closely packed against each other that they appear no longer to yield to the effort of vegetation which would press them out to the circumference." Adopted by botanists in general, this theory received an important consecration when De Candolle founded on this character his division of [the higher] vegetables into Endogens and Exogens. Notwithstanding that the labours of MM. Mohl, Unger, Mirbel, &c., have since more than sufficiently demonstrated that these plants are not really Endogenous, there remains a fundamental difference between the structure of the stems of the two sub-kingdoms of Cotyledonous plants.

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* Many of our readers are probably more accustomed to see the cryptogamic sub-kingdom of plants divided at once, as we ourselves recommend, into three classes, which may be named *Acrogens, Anogens*, and *Thallogens*. In the first there is always more or less approach to a vascular system, though never either all the kinds of vessels, or any similar arrangement of them, which are found in higher plants, and the true reproductive organs are found in a prothallus. In the second, with a structure entirely cellular, there is always more or less distinction of stem and foliage, the green colour of vegetation is retained, and the archegonia are produced on some point of the plant itself—not on a prothallus. In the third the stem and leaves are more or less completely confounded together, other colours are substituted for the usual vegetable green, and lower reproductive types prevail. It is obvious that this difference of method does not affect the author's argument.

The anatomical researches in relation to Monocotyledonous plants, although already very numerous, have not extended to a sufficient variety of families to enable us to form a precise judgment on the assistance which anatomical knowledge might afford in respect to the division of the sub-kingdom into classes and families. We know, however, that in this view the Liliaceæ, especially *Dracaena* and *Cordyline,* differ from the Palms, which have generally been assumed as the type. We also know that the fistulose culm of Graminaceæ offers remarkable peculiarities in the disposition of its fibres, especially in respect to their crossing one another at the knot. Finally, it has been more recently ascertained that the Orchidaceæ, especially in their appendicular parts, have anatomical elements exhibiting a special structure.

The immense sub-kingdom of Dicotyledonous plants has given occasion to a much greater number of researches, of which we can already, to a certain extent, appreciate the results. It is no longer permitted to a botanist to consider all the plants as having identical interior arrangements, and to give, for example, the stems of certain Amentaceæ as a type to which they all conform. It is, on the contrary, extremely probable that these stems, whilst preserving something of a common type, and presenting some characters which belong to the whole sub-kingdom, display in their structure, according to the families to which they belong, extensive variations both in the intimate structure of the constituent elements taken separately, and in the arrangement in relation to each other of these elements so as to constitute the complete vegetable.

But, however numerous, the researches of this kind made up to the present time still amount to very little, if we compare them with the immensity of the field which remains to be explored; and yet they already tend to shew an evident and remarkable relation between anatomical structure and classification.

[The author then enters upon the peculiarities of internal structure belonging to the Gymnosperms, and points out the error of those who have supposed the same peculiarities to occur in any other tribes. He goes on to sketch the history of anatomical research in relation to the particular families, concluding with a reference to the important work, still in progress, of M. Chatin. We conclude our extract with a few paragraphs through which M. Regnault approaches his own special investigations, upon the particulars of which it is out of our power now to enter.]

The structure of stems may vary much, not only according to the position of the plant in a natural classification, but also according to the conditions of vegetation in which it lives, the medium in which it grows, &c. Those stems which unite with a ligneous substance the property of climbing, have in general a structure modified in reference to this particular function; and if some families, as that of Lardisabalaceæ, long since studied by M. Decaisne (*Archives du Museum d' Histoire Naturelle*, 1839) are made up entirely of climbers, there are many others, such as Bignoniaceæ, Sapindaceæ, Malpighiaceæ, Convolvulaceæ, which, whilst they have woody climbing genera, contain also plants capable of supporting themselves independently. Long since, Adrien de Jussieu drew attention to the fact (*Dict. d'histoire Naturelle*, xii. 432), that in these variously constructed plants belonging to the same family, the essential anatomical characters remain unchanged, equally in the climbing species and the others; only in the former they unite themselves with other characters common to all climbers, and a practical eye will always recognise to which of the above-named families a section of a trunk belongs which is brought under his notice. Comparative anatomy must here, then, according to A. de Jussieu, have a double value, being able at the same time to make us acquainted with the natural group to which the plant belongs, and to indicate to a certain extent the mode of growth of the species. Numerous observations are evidently necessary before the facts of vegetable anatomy are sufficiently known for us to be able to give them so precise a signification. It is even probable that the facts so positively affirmed by A. de Jussieu, would need, from a reasonable regard to the interest attaching to them, to be confirmed by new observations; but it is possible that the rapid progress made may enable science to bring forward other similar results.

Such progress can only be the fruit of prolonged study, carried out with care and patience, and applied to a great number of distinct plants. The life of a single botanist would doubtless be insufficient to conduct such inquiries to a satisfactory conclusion; but the united efforts of many labourers may hasten the solution of the problem. I have desired by these researches to bring my stone to the common edifice. I have no doubt whatever that complementary studies, which can only be the work of time, will succeed in demonstrating in this purely anatomical portion of the history of vegetables, the same principle of which the application to external forms, and to the general constitution of all organised bodies, is the just subject of our admiration :—*Variety within unity*, not a blind and unregulated variety, but a variety controlled by laws, following in general in respect to the appearance of the different forms which it originates, the natural relations of objects.

There is a group of vegetables, which, whilst sufficiently differing among themselves in the arrangement of the flower and fruit, in the vegetative organs, and in a great number of important characters, nevertheless present certain points of agreement which have caused them to be brought together by a great number of botanists. They are Dicotyledonous plants, whose seed generally contains a copious farinaceous albumen, and an embryo, in most cases considerably developed, surrounding the albumen, contrary to the more usual arrangement : in consequence of which singular structure, botanists have united them under the name of *Cyclospermeæ*.

The knowledge of the internal structure of these plants cannot fail to be very precious for the determination of the value of anatomy as an element of classification. Will all these plants be found to offer some general anatomical characters corresponding with their union in a natural group, along with certain special characters belonging to the plants which constitute each family? Answered in the affirmative, this question, besides the interest directly attaching to the knowledge of these facts, would tend to confirm the opinion of Mirbel on the relations of internal structure with other botanical characters. . . . .

W. H.

# SCIENTIFIC AND LITERARY NOTES.

## ZOOLOGY.

The following note, taken from the "Proceedings of the Zoological Society, December 10th, 1861," and published in the "Annals and Magazine of Natural History for April, 1862," has a peculiar interest for Canadian Zoologists at the present time. During last winter, several specimens of *Anas glocitans* or *Anas bimaculata* were procured at the St. Clair flats. One of these is in the possession of Geo. W. Allan, Esq., M.L.C.; another was presented to the Museum of the University of Toronto, by Mr. Barber, from whom a communication on the subject to the Canadian Institute was also expected. From several characters of the birds examined by us; from the amount of variation in the invividual specimens; and from the strongly expressed opinion of several experienced sportsmen, who had on various occasions seen examples, we were inclined to conclude that the supposed species is a hybrid, one of the parents being the *Anas boschas.* This view is supported by Mr. Newton's note; yet for our complete satisfaction, further information on the subject is desirable.

### ON A HYBRID DUCK.—BY ALFRED NEWTON, M.A., F.L.S., F.Z.S.

I am indebted to the kindness of my friend, Mr. Newcome, for the opportunity of exhibiting to the Society a specimen of a fine hybrid duck, beautifully mounted by Mr. Ellis, of Swaffham, which presents several points of interest.

This bird (a male) was bred by Mr. Durham, of Bremley Grange, near Ripon, from a male widgeon (*Mareca Penelope*, Selby) and a female which was a cross between the common wild duck (*Anas boschas*, Linn.) and an ordinary farmyard duck. It was sent to Mr. Newcome by the intelligent gamekeeper at Hornby Castle, Mr. Anthony Savage, from whom I learn that Mr. Durham has since bred several other hybrids from the same male widgeon and a female of the domesticated variety of *Anas boschas* known as the "Grey Call Duck." Of these hybrids, Mr. Savage informs me that he sent a pair to Mr. Grantley Berkeley, and another pair to Mr. John Hancock.

No detailed notice of the particular cross I now exhibit has, to my knowledge, been hitherto published, though Mr. Yarrell, in the last edition of his work ('B. B.' ed. 3, iii. p. 276) mentions the fact as having occurred; and my friend, M. de Selys-Longchamps, who has, it is well known, devoted especial attention to the subject, informed me about two years ago that he was aware of other instances of such a hybrid. According to the views of the last-named accurate observer, the *Anas bimaculata* of Keyserling and Blasius*—the *Anas glocitans* of Gmelin (but not of Pallas)—is the result of this cross; and Mr.

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* Several writers assign the authority of Pennant for the trivial name "*bimaculata*." I cannot trace it further back than the "Wirbelthiere Europas" of the naturalists I have mentioned. There is no question about the *Anas glocitans* of Pallas being a good species, but I do not know any recorded instance of its occurrence in Europe.

Berkeley has also expressed a similar opinion (*Field*, March 16, 1861). With the greatest deference to these authorities, my own idea is that the birds so denominated have descended from the wild duck (*Anas boschas*, Linn.) and the teal (*Querquedula crecca*, Steph.), as has already been suggested by Mr. Tomes and Mr. Bartlett (*Zoologist*, p. 1698); and I have arrived at this conclusion not only from repeated examinations of the specimens described by Mr. Vigors (Linn. Trans. xiv. p. 559), which are now in the British Museum, but also from having seen several other birds of the same kind in different collections.

The principal distinctions observable between the subject of the present notice and the so-called *Anas bimaculata* are in the greater size of the former, and in the comparative obsoleteness of the dark patch which, in that supposed species, separates the light-coloured spots on the sides of the head. In the bird I now submit to your notice, this patch is reduced to a mere line, scarcely perceptible until looked for. The breast also wants the well-defined dark spots which are characteristic of the hybrid known as the "Bimaculated Duck."

## MISCELLANEOUS.

We copy from a recent number of a very promising new scientific periodical, *The Popular Science Review*, a notice of the "Fiftieth Anniversary of the Liverpool Literary and Philosophical Society," one of the oldest and most important of its class.

### THE FIFTIETH ANNIVERSARY OF THE LIVERPOOL LITERARY AND PHILOSOPHICAL SOCIETY.

Liverpool possessed a Literary and Philosophical Society in 1790; not the one which has just celebrated its fiftieth natal day, but another, with which was connected the name of Edward Rushton, the founder of the "School for the Blind," an institution which still calls forth the admiration of all strangers who visit Liverpool.

The present Literary and Philosophical Society was founded on the 13th March, 1812, when fifty-six gentlemen enrolled themselves as members; but it was not until December, 1817, that the Society rendered its name permanent by the election as member, and on the same evening as its president, of William Roscoe.

Here is Mr. Roscoe's letter to the secretary, accepting office:—

"My Dear Sir,—May I beg that you will take an early opportunity this evening to express my respectful thanks to the Literary and Philosophical Society for the honour they have done me, and which you so obligingly announced to me, in admitting me a member and nominating me to the distinguished situation of their president,—a situation the duties of which I shall be happy to discharge to the utmost of my power. If it will not be informal for me to make my appearance amongst you this evening, I will be in attendance in the ante-room, and will wait their pleasure.

"I am, my dear Sir, most faithfully yours,

"Wm. Roscoe."

Mr. Roscoe was introduced at the evening meeting, the members rose to receive him, and he signed the laws.

Amongst the gentlemen known in literary and scientific circles, who have since held office as presidents, we may mention Dr. Traill, J. B. Yates, F.S.A., Dr. Booth, F.R.S.. Dr. Dickenson, F.R.S. The present occupier of the presidential chair, the Rev. H. H. Higgins, is most zealous in his encouragement of science, being an active vice-president of the Naturalist's Field Club; as is also Dr. C. Collingwood, the secretary of the Literary Society,—a gentleman well known in the scientific world for his contributions to natural history.

It is no wonder that a society which, as our readers will perceive, has acquired more than a local reputation in the annals of science and literature, should seek to give some *éclat* to the silver year of its existence; and we find accordingly, that under its auspices the town-hall of Liverpool was thronged on the 13th of last month with a concourse of nearly 1,500 ladies and gentlemen.

The "west drawing-room" was devoted to the exhibition of philosophical instruments, electrical and other experiments, and telegraphic printing; the "east drawing-room" to books, autographs, and manuscripts; the most conspicuous of the last-named being one of Roscoe's, of the Life of Leo X. The remaining saloons were devoted to the arts, to music, and painting; and the council-chamber, &c., to refreshments.

The music consisted chiefly of part-songs, beautifully executed by the German "Lieder Tafel." The paintings in oil and water-colours, which were the property of the merchants and gentry in and around Liverpool, were collected and well hung under the superintendence of Arnold Baruchson, Esq., a patron of art in the town.

The Rev. President delivered a short address in one of the saloons during the evening, in which he sketched the history ef the Society; and his place was then occupied by the only surviving founder present, the venerable and much-esteemed William Rathbone, the friend of Roscoe, as well as of all that is good and useful in Liverpool. He addressed those around him as his "children," and called up old associations in the minds of many who had lived with him when science was a heresy. After these addresses the concert followed, and brought the proceedings of the evening to a close.

Such meetings as this, and others, of which we hope to be able to record a goodly and increasing number in each new issue, are calculated to place science in its true light, not as a dry study, hemmed in by obstacles insurmountable by the populace, but as one of the chief occupations that render life useful and agreeable.

## CANADIAN INSTITUTE.

### Session—1861-62.

FIFTH ORDINARY MEETING—25*th January*, 1862.

Hon. J. H. Hagarty, President, in the Chair.

I. The Rev. Professor Hatch, M.A., read a paper entitled "The Physical Theory of Heracleitus."

### SIXTH ORDINARY MEETING—1*st February*, 1862.

Hon. J. H. HAGARTY, President, in the Chair.

I. *The following donation to the Library was announced, and the special thanks of the Institute voted to the Donor:*

From the HON. G. W. ALLAN, M.L.C.

Gould's Monograph of the Trochilidæ, five parts, which completes the work.

II. Rev. W. H. Stewart, Guelph, proposed as a member of the Institute at the last meeting, was ballotted for and duly elected.

III. *The following Papers were read:*

1. By Professor D. Wilson, LL.D.:
"On apparent Traces of Works of Art in the American Drift."

2. By T. C. Keefer, Esq., Civil Engineer:
"On Ice Phenomena."

### SEVENTH ORDINARY MEETING—8*th February*, 1862.

Hon. J. H. HAGARTY, President, in the Chair.

I. *The following Gentlemen were elected members:*

SAMUEL C. DUNCAN CLARKE, Esq., Toronto.
THOMAS WELLS, Esq., Toronto.

II. *The following Papers were read:*

1. By Professor Croft, D.C.L.:
"On Toxicology, illustrating the application of Chemical Science in elucidating questions relative to poisoning cases in Jurisprudence."

2. By Rev. Professor W. Hincks, F.L.S.:
"Note on a Canadian Specimen of the Sula Bassana Solan Goose or Gannett."

### EIGHTH ORDINARY MEETING—15*th February*, 1862.

Third Vice-President, SANDFORD FLEMING, Esq., C.E., in the Chair.

The meeting was adjourned to the next Saturday, on motion of P. Freeland, Esq., seconded by Dr. Morris.

### NINTH ORDINARY MEETING—22*nd February*, 1862.

Hon. J. H. Hagarty, President, in the Chair.

I. *The following donation to the Library, received since last meeting, was announced by the Secretary, viz.:*

"The Bombay Magnetical and Meteorological Observations, for the year 1859." The thanks of the Institute were ordered to be rendered for the above donation.

II. *The following papers were read:*

1. By Dr. Beverley R. Morris:
"On the habits of some water birds."

2. By Professor G T. Kingston, M.A.:
"The Toronto Meteorological Report for 1861."

### TENTH ORDINARY MEETING—1*st March*, 1862.

The First Vice-President, the Rev. Prof. G. C. Irving, M.A., in the Chair.

I. *The following donation to the Library was announced, and the thanks of the Institute voted to the donor, J. D. Campbell, Esq.:*

"Doomsday Book; or, The Great Survey of England of William the Conqueror, relating to Cornwall. Fac-simile photo-zincographed by Her Majesty's command, at the Ordnance Survey Office, Southampton. Col. Sir Henry James, R.E., F.R.S., &c., director. 1861."

II. *The followidg Papers were read:*

1. By the Rev. Prof. Hatch, B.A.:
   "A Sketch of the Pre-Socratic Philosophers."
2. By James Bovell, Esq., M.D.:
   "Some recent Theories of Cell development, with Microscopical Illustrations."

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### ELEVENTH ORDINARY MEETING—8*th March*, 1862.

Hon. J. H. Hagarty, President, in the Chair.

I. *The following Papers were read:*

1. By the Rev. G. P. Young, M.A.:
   "Remarks on an argument of Dr. Whewell, against the claims of the Parmenides to be considered a genuine Dialogue of Plato."
2. By Prof. Wilson, LL.D.:
   "On the aim of Shakespeare, in his Historical Dramas, as illustrated in his *King John*."

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### TWELFTH ORDINARY MEETING—15*th March*, 1862.

In the absence of the President and Vice-Presidents, Prof. Wilson, LL.D., was called to the chair.

I. *The following Paper was read:*

By Prof. Croft, D.C.L.:
"On the supposed existence of Benzole in Canadian Petroleum."

Prof. Chapman made a communication relative to the occurrence of the Phenomenon of Mock Suns, as observed by Mr. Clifford Thompson, P.L.S., near the mouth of the Muskoka River, in November last.

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### THIRTEENTH ORDINARY MEETING—22*nd March*, 1862.

In the absence of the President and Vice-Presidents, Prof. Wilson, LL.D., was called to the chair.

I. *The following gentleman was elected a member:*

F. E. Dixon, Esq., Toronto.

II. *The following donation for the Library was announced, and the thanks of the Institute voted to the donors, the Royal Society of Edinburgh:*

"Proceedings of Session 1860–61."
"Transactions of do." Vol. xxii. Part 3.

III. *The following papers were read:*

1. By Professor E. J. Chapman:
"Remarks on some recent Announcements and Discoveries in Natural Science."
2. By W. Ogden, M.D.:
"On an Atmospheric Cause of Disease."

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FOURTEENTH ORDINARY MEETING—29*th March*, 1862.

Second Vice-President, T. C. KEEFER, Esq., C.E., in the Chair.

I. *The following Papers were read:*

1. By the Rev. Prof. G. P. Young, M.A.:
"Note on a Passage in the Euthypkro of Plato."
3. By the Rev. Prof. Hincks, F.L.S.:
"An Inquiry into the natural Laws which regulate the Interchange of Commodities between Individuals and Nations, and the effects of interference with them."

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FIFTEENTH ORDINARY MEETING—5*th April*, 1862.

Hon. J. H. HAGARTY, President, in the Chair.

I. *The following Auditors were appointed:*

S. B. HARMAN, Esq.
G. WILSON, Esq.

II. *The following Papers were read:*

1. By the Rev. Prof. Hatch, B.A.:
"On the Relation of the Volscian Language to others of the Italian Family."
2. By Prof. Wilson:
"On the Influence of Mediæval Art on the subsequent forms of Literature."

The President stated that the Annual Converzazione would be held on the 24th instant.

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SIXTEENTH ORDINARY MEETING.—3*rd May*, 1862.

First Vice-President, Rev. Prof. G. C. IRVING, M.A., in the Chair.

I. *The following Gentlemen were elected Members:*

GEORGE LANE REID, Esq., C.E., Hamilton.
WILLIAM BOULTBEE, Esq., C.E., Hamilton.

II. *The following donation to the Library was announced, and the thanks of the Institute voted to the donor, John Lovell, Esq., Montreal:*

"Catalogue of Economic Minerals of Canada transmitted to the International Exhibition."

III. *The following Papers were read:*

1. By Lieut. Ormsby, R.A.:
"On Modern English Guns."
2. By the Rev. Prof. Hatch, B.A.:
"On the Light which is thrown by the latest results of the Science of Language upon the Early History of Mankind."

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST—FEBRUARY, 1862.

*Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 min. 33 sec. West. Elevation above Lake Ontario, 108 feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resultant Direction. | Velocity of Wind. | | | | | Rain in Inches. | Snow in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | MEAN. | 6 A.M | 2P.M. | 10PM | ME'N | | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M. | 2 P.M. | 10 P.M. | | 6 A.M | 2 P.M | 10PM | Re-sul't. | ME'N | | |
| 1 | 29.580 | 29.634 | 29.860 | 29.7035 | 28.7° | 33.4° | 17.6° | 26.33° | + 2.45° | .138 | .126 | .076 | .109 | .87 | .66 | .79 | .76 | S | W | W N W | N 89° W | 0.6 | 11.0 | 4.0 | 4.83 | 5.01 | ... | Inp. |
| 2 | .980 | 30.023 | — | — | 16.8 | 24.1 | — | — | — | .085 | .107 | — | — | .91 | .82 | — | — | W | W b N | Calm. | N 72 W | 2.8 | 10.8 | 0.0 | 4.41 | 5.62 | .. | ... |
| 3 | .951 | 29.711 | .628 | .7543 | 12.5 | 23.1 | 20.1 | 19.08 | — 4.68 | .067 | .112 | .091 | .090 | .88 | .90 | .85 | .86 | N E b N | E b S | N E b N | N 76 E | 5.5 | 10.2 | 5.0 | 5.71 | 7.36 | ... | 1.2 |
| 4 | .759 | .837 | .952 | .8612 | 17.6 | 24.1 | 20.1 | 20.53 | — 3.15 | .083 | .107 | .091 | .096 | .85 | .82 | .85 | .86 | N W b N | W | W N W | N 63 W | 3.0 | 2.8 | 7.0 | 3.35 | 3.47 | ... | 1.0 |
| 5 | 30.010 | .888 | .697 | .8537 | 11.8 | 29.5 | 31.3 | 24.20 | + 0.62 | .063 | .113 | .160 | .116 | .86 | .69 | .90 | .84 | Calm. | S E | E | S 72 E | 0.0 | 4.0 | 6.2 | 3.95 | 4.18 | ... | ... |
| 6 | 29.432 | .107 | .366 | .3088 | 32.4 | 35.2 | 35.3 | 34.53 | +11.02 | .169 | .190 | .139 | .170 | .91 | .93 | .67 | .85 | E | S E | W b N | N 76 W | 2.2 | 2.0 | 25.8 | 9.18 | 13.39 | 0.125 | 0.5 |
| 7 | .619 | .715 | .821 | .7263 | 30.2 | 29.1 | 16.8 | 24.47 | + 1.03 | .149 | .118 | .080 | .109 | .89 | .73 | .85 | .81 | W b N | N W b N | N b W | N 49 W | 13.0 | 10.0 | 2.5 | 6.61 | 8.08 | ... | ... |
| 8 | .823 | .685 | .633 | .7082 | 13.2 | 16.1 | 15.0 | 14.90 | — 8.47 | .071 | .081 | .075 | .077 | .90 | .90 | .87 | .90 | N N E | E N E | Calm. | N 56 E | 4.8 | 1.0 | 0.0 | 1.87 | 2.91 | ... | 1.0 |
| 9 | .522 | .655 | — | — | 18.6 | 19.4 | — | — | — | .083 | .080 | — | — | .83 | .77 | — | — | W b S | W N W | N W | N 80 W | 15.5 | 12.0 | 1.5 | 8.98 | 9.21 | ... | 0.4 |
| 10 | .688 | .561 | .431 | .5453 | 14.0 | 23.0 | 21.9 | 19.62 | — 3.65 | .075 | .106 | .084 | .086 | .91 | .86 | .71 | .80 | W N W | S W b S | S W | S 18 W | 1.5 | 5.0 | 4.5 | 3.90 | 4.32 | ... | Inp. |
| 11 | .246 | .080 | .024 | .1122 | 25 5 | 27.3 | 32.0 | 28.63 | + 5.37 | .104 | .139 | .173 | .142 | .75 | .94 | .96 | .89 | S | S E b E | S b W | S 16 E | 8.8 | 9.0 | 8.5 | 7.39 | 10.23 | ... | 2.5 |
| 12 | .237 | .380 | .585 | .4178 | 30.2 | 32.0 | 27.7 | 29.42 | + 6.17 | .157 | .115 | .135 | .133 | .93 | .62 | .89 | .82 | W S W | W b S | Calm. | S 86 W | 9.0 | 15.0 | 0.0 | 5.27 | 6.92 | ... | 0.2 |
| 13 | .545 | .510 | .513 | .5157 | 26.9 | 25.9 | 29.1 | 26.70 | + 3.45 | .131 | .120 | .155 | .131 | .89 | .86 | .96 | .90 | E N E | E N E | S S W | N 38 E | 6.4 | 5.0 | 3.5 | 2.89 | 6.23 | ... | 1.5 |
| 14 | .514 | .670 | .772 | .6687 | 19.0 | 15.0 | 5.7 | 12.03 | —11.23 | .091 | .057 | .047 | .061 | .89 | .65 | .82 | .77 | N W b N | W N W | N | N 57 W | 21.0 | 16.5 | 4.0 | 8.96 | 9.51 | ... | ... |
| 15 | .742 | .649 | .571 | .6497 | —3.0 | 14.1 | 12.9 | 9.58 | —13.67 | .036 | .043 | .063 | .051 | .93 | .52 | .80 | .75 | Calm. | S W | W S W | S 67 W | 0.0 | 12.5 | 14.8 | 10.93 | 11.49 | ... | ... |
| 16 | .895 | 30.037 | — | — | 3.9 | 16.1 | — | — | — | .045 | .068 | — | — | .86 | .75 | — | — | W b N | S S W | N N E | N 21 W | 3.8 | 2.5 | 2.0 | 1.41 | 3.04 | ... | ... |
| 17 | .909 | 29.729 | .587 | .7288 | 15.8 | 27.7 | 31.6 | 25.70 | + 2.35 | .078 | .135 | .170 | .132 | .88 | .89 | .96 | .92 | N E b N | E N E | E S E | N 78 E | 7.5 | 13.5 | 6.5 | 6.45 | 8.61 | 0.030 | ... |
| 18 | .532 | .708 | .891 | .7265 | 33.4 | 35.2 | 29.5 | 32.83 | + 9.40 | .188 | .140 | .121 | .149 | .98 | .68 | .74 | .79 | W S W | W b S | W b N | N 88 W | 10.8 | 14.5 | 8.0 | 10.60 | 11.25 | ... | ... |
| 19 | .863 | .670 | .364 | .6100 | 24.8 | 29.8 | 25.5 | 26.52 | + 2.98 | .112 | .140 | .133 | .127 | .84 | .84 | .96 | .88 | N b W | E N E | N E b N | N 38 E | 6.5 | 12.4 | 16.5 | 11.32 | 13.06 | ... | 8.0 |
| 20 | .514 | .730 | .937 | .7458 | 22.3 | 25.2 | 17.6 | 21.07 | — 2.55 | .115 | .080 | .088 | .093 | .96 | .59 | .92 | .83 | N W | N W b W | W | N 57 W | 14.5 | 20.0 | 1.5 | 10.66 | 11.29 | ... | 1.5 |
| 21 | .943 | .758 | .546 | .7383 | 10.7 | 29.5 | 21.2 | 21.42 | — 2.32 | .064 | .113 | .092 | .094 | .92 | .69 | .81 | .81 | W | S W b S | Calm. | S 45 W | 1.5 | 1.8 | 0.0 | 1.23 | 2.38 | ... | Inp. |
| 22 | .521 | .382 | .362 | .4092 | 25.2 | 33.4 | 30.2 | 29.72 | + 5.90 | .122 | .149 | .157 | .144 | .90 | .78 | .93 | .87 | W b N | S b E | Calm. | S 38 E | 1.0 | 3.0 | 0.0 | 0.47 | 1.52 | ... | ... |
| 23 | .303 | .199 | — | — | 28.8 | 35.6 | — | — | — | .144 | .187 | — | — | .90 | .89 | — | — | N E b E | E | N E | N 59 E | 4.0 | 3.4 | 1.0 | 3.48 | 4.19 | ... | 2.0 |
| 24 | .011 | .479 | .842 | .4818 | 31.6 | 15.4 | 11.1 | 18.85 | — 5.28 | .170 | .064 | .060 | .097 | .96 | .72 | .83 | .84 | N b E | N W | N W b W | N 42 W | 15.0 | 26.0 | 22.5 | 18.29 | 18.72 | ... | 3.0 |
| 25 | 30.096 | 30.017 | .864 | .9825 | —3.7 | 15.4 | 13.4 | 11.23 | —13.10 | .034 | .077 | .072 | .067 | .93 | .87 | .90 | .88 | N b W | S S W | N E | N 83 E | 2.8 | 0.5 | 3.5 | 2.84 | 4.36 | ... | ... |
| 26 | 29.582 | 29.395 | .275 | .4003 | 25.5 | 30.2 | 29.1 | 28.13 | + 3.60 | .118 | .157 | .155 | .142 | .86 | .93 | .96 | .92 | E b S | E | N E b E | N 55 E | 7.5 | 9.0 | 4.8 | 4.04 | 8.19 | 0.025 | 0.3 |
| 27 | .309 | .427 | .457 | .4085 | 25.5 | 22.1 | 15.1 | 20.30 | — 4.42 | .111 | .075 | .074 | .085 | .81 | .63 | .86 | .77 | N W b W | W N W | W N W | N 68 W | 21.2 | 23.5 | 13.0 | 19.76 | 19.83 | ... | In |
| 28 | .448 | .491 | .595 | .5278 | 11.1 | 16.5 | 15.0 | 14.18 | —10.72 | .065 | .069 | .069 | .066 | .92 | .77 | .79 | .81 | W N W | N W | N W b W | N 48 W | 20.0 | 28.5 | 23.0 | 23.99 | 24.13 | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ...... | ...... | ...... | ...... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ...... | ...... | ...... | ...... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ...... | ...... | ... .. | ...... | ... | ... | ... | ... | ... | ... | ... |
| M | 29.6197 | 29.5922 | 29.6072 | 29.6077 | 20.05 | 25.34 | 21.87 | 22.50 | — 1.17 | .105 | .109 | .107 | .107 | .89 | .77 | .86 | .84 | ...... | ...... | ...... | ...... | 7.51 | 10.19 | 6.77 | ..... | 8.52 | 0.180 | 23.1 |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR FEBRUARY, 1862.

Highest Barometer........................ 30.138 at 8 a. m. on 25th } Monthly range =
Lowest Barometer ........................ 29.011 at 6 a. m. on 24th } 1.127 inches.

Self-regist'ing Thermom. { Maximum Temperature ............... 37°8 on p.m. of 6th } Monthly range=
Minimum Temperature ............... —5°2 on a.m. of 15th } 43°0
Mean maximum Temperature ..................... 28°25 } Mean daily range=
Mean minimum Temperature ..................... 15°41 } 12°84
Greatest daily range ........... 30°0 from a. m. to p.m. of 25th.
Least daily range................. 3°4 from a. m. to p. m. of 7th.

Warmest day......... 6th... Mean temperature......... 34°53 } Difference = 24°95.
Coldest day......... 15th... Mean temperature......... 9°58 }
Maximum { Solar.................................. 65°0 on p. m. of 1st } Monthly range =
Radiation. { Terrestrial.............................. —12°9 on a. m. of 15th } 77°9

Aurora observed on 1 night, viz.: 28th.
Possible to see Aurora on 10 nights; impossible on 18 nights.
Snowing on 17 days, depth 23.1 inches; duration of fall, 73.4 hours.
Raining on 3 days,—depth 0.180 inches; duration of fall 14.0 hours.
Mean of cloudiness = 0.78. Above average 0.07.
Most cloudy hour observed, 6 a. m., mean = 0.89; least cloudy hour observed 10 p.m.; mean, = 0.67.

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*Sums of the components of the Atmospheric Current, expressed in miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 2121.56 | 626.73 | 1201.16 | 3374.57 |

Resultant direction N. 55° W.; Resultant velocity 3.81 miles per hour.
Mean velocity............................ 8.52 miles per hour.
Maximum velocity ..................... 34.8 miles, from 2 to 3 p. m. on 24th.
Most windy day ......28th ...........Mean velocity, 24.13 miles per hour. } Difference=
Least windy day......22nd ...........Mean velocity, 1.52 ditto. } 22.61 miles.
Most windy hour ...11 a.m. to noon.........Mean velocity, 11.93 ditto. } Difference=
Least windy hour...midn't to 1 a.m..........Mean velocity 5.59 ditto. } 6.34 miles.

*Very Rapid Simultaneous Barometric and Thermometric Movement.*

BAROMETER. { 24th, 6 a. m. = 29.011 } Ascending Range = 1.127 in 26 hours.
25th, 8 a. m. = 30.138 } Descending Range = 0.917 in 40 hours.
26th, midn't = 29.221
Movement............................ = 2.044 in 66 hours.

THERMOMETER { 24th, a. m. 32°0 } Descending Range = 36°5 in 24 hours.
25th, a. m. —4°5 } Ascending Range = 35°5 in 34 hours.
26th, p. m. 31°0
Movement.................. = 72°0 in 58 hours.

6th. Dense fog at 2 p.m.; wind sprang up with great rapidity at 4 p.m.—10th. Very perfect lunar halo from 7.30 to 9 p.m; lunar corona at midnight.—14th. Lunar halo at midnight.—19th. Very heavy snow storm commenced at 4 p.m., and continued snowing and drifting furiously all night; ceased at 9 a.m. on 20th.—24th. Very stormy day, snowing and drifting heavily.—26th. Rain, freezing as it fell, from 4 p.m. to 2 a.m. of 27th.—28th. Wind very high and squally; zodiacal light bright at 7 p.m.

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### COMPARATIVE TABLE FOR FEBRUARY.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | Diff. above aver'ge (23°0) | Max. ob-served. | Min. ob-served. | Range. | No. of days. | Inches | No. of days. | Inhes | Resultant Direction. | Resultant V'y. | Mean Force or Velocity. |
| 1840 | 28.0° | + 5.0° | 49.1° | — 8.3° | 57.4° | 8 | 1.475 | 6 | ... | ... | ... | ........... |
| 1841 | 22.4 | — 0.6 | 43.4 | — 0.3 | 43.7 | 1 | Inap | 9 | ... | ... | ... | 0.61 lbs. |
| 1842 | 26.9 | + 3.9 | 48.7 | + 2.5 | 46.2 | 8 | 3.625 | 9 | ... | ... | ... | 1.03 |
| 1843 | 14.5 | — 8.5 | 37.5 | —10.2 | 47.7 | 1 | 0.475 | 21 | 14.4 | ... | ... | 1.05 |
| 1844 | 26.0 | + 3.0 | 47.1 | — 0.4 | 47.5 | 4 | 0.430 | 7 | 10.0 | ... | ... | 0.43 |
| 1845 | 26.0 | + 3.0 | 46.6 | — 3.9 | 50.5 | 5 | Imp. | 9 | 19.0 | ... | ... | 0.99 |
| 1846 | 20.4 | — 2.6 | 41.4 | —16.2 | 57.6 | 0 | 0.000 | 13 | 46.1 | ... | ... | 0.65 |
| 1847 | 21.5 | — 1.5 | 42.2 | — 1.0 | 43.2 | 2 | 0.550 | 13 | 27.3 | ... | ... | 0.69 |
| 1848 | 26.6 | + 3.6 | 46.9 | — 0.6 | 47.5 | 4 | 0.775 | 8 | 10.8 | N 65° W | 2.53 | 5.69mls. |
| 1849 | 19.5 | — 3.5 | 41.1 | — 9.2 | 50.3 | 2 | 0.240 | 13 | 19.2 | N 41° W | 1.48 | 6.58 |
| 1850 | 26.0 | + 3.0 | 49.2 | + 1.3 | 47.9 | 7 | 1.235 | 9 | 23.1 | N 80° W | 3.43 | 7.61 |
| 1851 | 27.6 | + 4.6 | 50.2 | + 1.3 | 48.9 | 7 | 2.600 | 4 | 2.4 | N 64° W | 1.99 | 6.94 |
| 1852 | 23.4 | + 0.4 | 41.2 | — 3.2 | 44.4 | 3 | 0.650 | 11 | 13.0 | S 75° W | 3.34 | 6.42 |
| 1853 | 24.1 | + 1.1 | 43.4 | — 0.6 | 44.0 | 4 | 1.030 | 15 | 12.6 | N 49° W | 2.51 | 7.30 |
| 1854 | 21.1 | — 1.9 | 42.7 | — 5.7 | 48.4 | 5 | 1.460 | 15 | 18.0 | N 7° E | 1.73 | 6.91 |
| 1855 | 15.4 | — 7.6 | 37.3 | —25.6 | 62.3 | 2 | 1.770 | 14 | 21.8 | N 40° W | 4.34 | 8.17 |
| 1856 | 15.7 | — 7.3 | 35.3 | —18.7 | 54.0 | 0 | 0.000 | 8 | 9.7 | N 81° W | 7.70 | 10.71 |
| 1857 | 28.5 | + 5.5 | 51.2 | — 5.9 | 57.1 | 11 | 3.050 | 11 | 11.7 | S 78° W | 3.68 | 9.82 |
| 1858 | 17.0 | — 6.0 | 40.9 | — 6.6 | 47.5 | 1 | Inap | 16 | 26.7 | N 72° W | 3.22 | 9.12 |
| 1859 | 26.0 | + 3.0 | 43.3 | + 3.9 | 39.4 | 6 | 0.455 | 14 | 8.3 | N 54° W | 2.72 | 8.50 |
| 1860 | 22.8 | — 0.2 | 48.1 | — 8.4 | 56.5 | 7 | 1.330 | 13 | 18.8 | N 61° W | 3.28 | 8.73 |
| 1861 | 26.1 | + 3.1 | 44.6 | —20.4 | 65.0 | 4 | 0.815 | 17 | 29.7 | N 77° W | 3.86 | 10.58 |
| 1862 | 22.5 | — 0.5 | 35.6 | — 3.7 | 39.3 | 3 | 0.180 | 17 | 23.1 | N 55° W | 3.81 | 8.52 |
| Results to 1861. | 22.98 | ... | 44.15 | —6.16 | 50.32 | 4.2 | 1.046 | 11.6 | 18.03 | N 69° W | 3.02 | 8.08 |
| Diff. for 1862. | — 0.48 | ... | — 8.55 | +2.46 | — 11.02 | — 1.2 | — 0.866 | + 5.4 | + 5.07 | ......... | ...... | + 0.44 |

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—MARCH, 1862.

*Latitude*—43 *deg.* 39.4 *min. North. Longitude*—5 *h.* 17 *m.* 33 *s. West. Elevation above Lake Ontario,* 108 *feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resul't. Direction. | Velocity of Wind. | | | | | Rain in inches. | Snow in inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | Mean. | 6 A.M | 2 P.M | 10PM | ME'N | | 6 A.M. | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A. M. | 2 P. M. | 10 P. M. | | 6 AM. | 2 PM. | 10 P.M. | Resul't. | ME'N | | |
| 1 | 29.625 | 29.599 | 29.681 | 29.6382 | °12.5 | °25.9 | °15.4 | °17.75 | — °7.47 | .062 | .093 | .070 | .075 | .80 | .66 | .80 | .76 | N W | N W | NW b N | N °42 W | 15.0 | 16.4 | 11.0 | 10.78 | 11.17 | ... | 0.5 |
| 2 | .628 | .681 | — | — | 9.3 | 24.0 | — | — | — | .062 | .115 | — | — | .94 | .89 | — | — | N b E | E N E | N E | N 58 E | 8.2 | 6.4 | 9.0 | 9.92 | 10.55 | ... | ... |
| 3 | .319 | .069 | 28.849 | .0588 | 26.2 | 31.3 | 34.9 | 30.70 | + 4.98 | .110 | .174 | .203 | .163 | .77 | .99 | 1.00 | .94 | E b N | E | S E | S 79 E | 19.5 | 17.0 | 11.4 | 7.90 | 16.73 | 0.700 | 3.0 |
| 4 | 28.992 | .111 | 29.270 | .1372 | 21.9 | 25.2 | 24.1 | 23.78 | — 2.22 | .097 | .101 | .120 | .107 | .82 | .74 | .93 | .83 | W S W | S W b W | S W b W | S 67 W | 17.0 | 18.5 | 5.5 | 8.36 | 16.81 | ... | ... |
| 5 | 29.272 | .280 | .308 | .2912 | 21.9 | 27.0 | 21.9 | 23.07 | — 3.13 | .105 | .115 | .097 | .103 | .89 | .77 | .82 | .82 | W b S | W b S | W | S 87 W | 5.0 | 9.4 | 9.0 | 7.83 | 8.10 | ... | Inp. |
| 6 | .285 | .325 | .418 | .3475 | 19.4 | 29.5 | 24.4 | 24.68 | — 1.82 | .087 | .136 | .103 | .111 | .83 | .83 | .78 | .83 | W N W | S W b W | W b S | S 83 W | 6.5 | 10.0 | 8.4 | 7.72 | 8.40 | ... | ... |
| 7 | .425 | .486 | .545 | .4967 | 25.5 | 37.8 | 34.5 | 32.83 | + 6.02 | .118 | .157 | .157 | .147 | .86 | .69 | .78 | .78 | W b N | W b N | NW b W | N 65 W | 4.8 | 2.5 | 8.5 | 5 22 | 5.61 | ... | ... |
| 8 | .624 | .672 | .758 | .6962 | 32.4 | 36.7 | 34.5 | 34.52 | + 7.28 | .153 | .144 | .173 | .153 | .83 | .66 | .86 | .77 | NW b N | N | S b E | N 76 W | 6.5 | 3.8 | 2.0 | 2.50 | 4.19 | ... | ... |
| 9 | .803 | .690 | — | — | 33.4 | 38.1 | — | — | — | .171 | .169 | — | — | .89 | .74 | — | — | E b S | E | E | S 72 E | 4.0 | 11.5 | 5.0 | 7.36 | 7.91 | 0.370 | ... |
| 10 | .345 | .168 | .506 | .3532 | 37.8 | 38.8 | 32.7 | 35.95 | + 8.13 | .217 | .229 | .135 | .190 | .95 | .97 | .73 | .88 | S S E | S W b S | W | S 81 W | 6.0 | 9.0 | 17.0 | 9.77 | 11.50 | 0.160 | ... |
| 11 | .686 | .640 | .561 | .6275 | 25.5 | 35.3 | 29.8 | 30.38 | + 2.15 | .118 | .164 | .133 | .137 | .86 | .80 | .80 | .81 | W | S W b S | W S W | S 60 W | 7.4 | 13.0 | 5.0 | 6.93 | 7.55 | ... | ... |
| 12 | .556 | .664 | .846 | .7018 | 24.1 | 32.0 | 24.1 | 27.02 | — 1.53 | .114 | .106 | .114 | .107 | .87 | .58 | .87 | .74 | S W | NW b W | N b E | N 45 W | 3.5 | 20.4 | 3.5 | 8.35 | 12.46 | ... | 0.1 |
| 13 | .824 | .746 | .720 | .7612 | 21.2 | 28.0 | 25.5 | 25.25 | — 3.75 | .092 | .124 | .111 | .111 | .81 | .81 | .81 | .81 | E N E | E b N | E N E | N 75 E | 11.0 | 17.4 | 9.8 | 12.28 | 12.35 | ... | 0.1 |
| 14 | .695 | .658 | .561 | .6285 | 25.5 | 30.9 | 30.6 | 29.25 | — 0.07 | .125 | .134 | .160 | .139 | .91 | .77 | .93 | .86 | E N E | E N E | E | N 61 E | 7.0 | 5.5 | 13.5 | 8.04 | 8.59 | 0.525 | ... |
| 15 | .400 | .246 | .147 | .2537 | 32.0 | 32.7 | 30.6 | 31.63 | + 1.92 | .181 | .172 | .168 | .171 | 1.00 | .92 | .98 | .96 | N E b E | N E b E | N E b N | N 48 E | 8.8 | 10.0 | 11.0 | 10.33 | 10.44 | 0.745 | 3.0 |
| 16 | .162 | .225 | — | — | 27.3 | 31.6 | — | — | — | .139 | .148 | — | — | .94 | .83 | — | — | N E | N E b E | E N E | N 28 E | 7.4 | 7.0 | 4.0 | 3.77 | 4.60 | Inp. | 1.0 |
| 17 | .400 | .447 | .548 | .4747 | 22.6 | 34.2 | 30.2 | 29.58 | — 0.87 | .103 | .168 | .149 | .144 | .85 | .85 | .89 | .87 | N b W | N b W | N b W | N 23 W | 3.0 | 6.5 | 4.5 | 4.68 | 5.23 | ... | ... |
| 18 | .682 | .771 | .828 | .7640 | 23.3 | 37.0 | 27.0 | 28.75 | — 2.10 | .110 | .114 | .129 | .121 | .87 | .51 | .88 | .78 | N b W | S b W | NW b N | N 49 W | 6.0 | 3.8 | 5.0 | 1.56 | 3.97 | ... | ... |
| 19 | .814 | .762 | .701 | .7433 | 20.8 | 35.6 | 27.3 | 28.22 | — 3.05 | .097 | .142 | .126 | .120 | .87 | .68 | .85 | .78 | N E b N | S W b S | N N E | N 56 E | 3.5 | 1.0 | 7.0 | 3.00 | 4.51 | ... | ... |
| 20 | .656 | .572 | .441 | .5422 | 27.0 | 33.4 | 33.8 | 30.97 | — 0.70 | .121 | .134 | .144 | .131 | .82 | .70 | .75 | .75 | N E b E | E | E | N 80 E | 10.0 | 15.8 | 22.0 | 16.89 | 17.11 | ... | 9.0 |
| 21 | .255 | .152 | .139 | .1743 | 29.8 | 33.1 | 31.6 | 31.57 | — 0.52 | .162 | .185 | .163 | .170 | .98 | .98 | .91 | .96 | E | E b N | N | N 63 E | 22.5 | 11.8 | 7.6 | 9.14 | 11.57 | ... | 1.5 |
| 22 | .068 | .047 | .119 | .0810 | 30.6 | 35.6 | 30.6 | 31.90 | — 0.58 | .160 | .177 | .160 | .165 | .93 | .85 | .93 | .91 | N W | S S W | W | N 85 W | 6.0 | 8.4 | 2.0 | 3.67 | 4.59 | 0.020 | 0.2 |
| 23 | .133 | .171 | — | — | 29.8 | 38.8 | — | — | — | .154 | .195 | — | — | .94 | .82 | — | — | W b N | NW b N | N N W | N 34 W | 2.5 | 8.8 | 20.5 | 12.26 | 12.50 | ... | ... |
| 24 | .322 | .386 | .446 | .3913 | 26.2 | 30.6 | 24.1 | 26.60 | — 6.57 | .131 | .108 | .114 | .117 | .92 | .63 | .87 | .82 | NW b N | NW b N | NW b W | N 39 W | 13.0 | 12.2 | 16.5 | 13.64 | 13.80 | . . | 0.1 |
| 25 | .515 | .544 | .589 | .5568 | 16.1 | 32.7 | 21.5 | 23.80 | — 9.77 | .081 | .143 | .088 | .101 | .90 | .76 | .77 | .78 | NW b W | NW b N | NW b N | N 50 W | 7.2 | 13.0 | 6.5 | 7.01 | 7.25 | ... | ... |
| 26 | .642 | .640 | .683 | .6545 | 13.2 | 34.2 | 27.7 | 26.30 | — 7.68 | .066 | .125 | .128 | .111 | .83 | .63 | .84 | .77 | W N W | S W b S | W N W | S 82 W | 5.0 | 9.2 | 2.5 | 3.21 | 4.01 | ... | ... |
| 27 | .692 | .636 | .682 | .6710 | 23.0 | 41.4 | 32.4 | 32.32 | — 2.10 | .106 | .135 | .124 | .120 | .86 | .51 | .67 | .67 | W | W N W | W | N 68 W | 1.5 | 14.6 | 8.6 | 8.18 | 8.87 | ... | ... |
| 28 | .713 | .701 | .776 | .7310 | 25.5 | 34.5 | 22.6 | 27.27 | — 7.45 | .116 | .128 | .104 | .105 | .86 | .64 | .86 | .72 | NW b N | N b W | N | N 2 E | 9.0 | 12.8 | 6.4 | 7.90 | 8.94 | ... | ... |
| 29 | .774 | .738 | .691 | .7303 | 21.2 | 29.8 | 30.6 | 27.98 | — 7.12 | .085 | .117 | .138 | .119 | .75 | .71 | .80 | .77 | N E | E b N | E | N 89 E | 8.8 | 12.5 | 10.8 | 10.74 | 11.00 | ... | ... |
| 30 | .602 | .453 | — | — | 32.4 | 35.3 | — | — | — | .161 | .158 | — | — | .87 | .77 | — | — | E | E | S S W | S 72 E | 13.0 | 19.0 | 3.5 | 7.53 | 11.32 | 0.040 | ... |
| 31 | .426 | .545 | .748 | .5865 | 36.3 | 38.5 | 35.2 | 36.43 | + 0.52 | .193 | .173 | .174 | .182 | .90 | .74 | .85 | .85 | S W b W | W b N | W N W | N 78 W | 10.0 | 17.4 | 15.0 | 14.31 | 15.12 | ... | ... |
| M | 29.5003 | 29.4848 | 29.5216 | 29.5036 | 24.67 | 33.14 | 28.37 | 28.79 | — 1.59 | .120 | .142 | .134 | .132 | .87 | .75 | .84 | .82 | ......... | ......... | ......... | ......... | 8.34 | 11.12 | 8.77 | ...... | 9.38 | 2.560 | 18.5 |

# REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR MARCH, 1862.

Highest Barometer . . . . . . . 29.828 at 10 p. m. on 18th. } Monthly range= 1.023 inches.
Lowest Barometer . . . . . . . 28.805 at 11 p. m. on 3rd.

Self-registering Ther.
- Maximum temperature . . . . 43°2 on p.m. of 27th } Monthly range= 35°2
- Minimum temperature . . . . 8°0 on a.m. of 2nd
- Mean maximum temperature . . 34°64 } Mean daily range=11°52
- Mean minimum temperature . . 23°12
- Greatest daily range . . . . . . 23°6 from a. m. to p. m. of 26th.
- Least daily range . . . . . . . 3.4 from a. m. to p. m. of 15th.

Warmest day . . . 31st ...Mean Temperature . . .=36°43 } Difference=18°68.
Coldest day . . . . 1st ...Mean Temperature . . .=17°75

Maximum Radiation { Solar . . . . . . . . . . 68°0 on p.m of 23rd } Monthly range= 72°.2
{ Terrestrial . . . . . . . . —4°2 on a. m. of 2nd

Aurora observed on 2 nights, viz.: 25th, and 27th; Possible to see Aurora on 13 nights; Impossible on 18 nights.

Snowing on 11 days: depth, 18.5 inches; duration of fall, 52.8 hours.

Raining on 8 days; depth, 2.560 inches; duration of fall, 54.0 hours.

Mean of cloudiness=0.63; above the average, 0.04. Most cloudy hour observed, 4 p.m.; mean=0.71; least cloudy hour observed, midnight; mean=0.55.

*Sum of the components of the Atmospheric Current, expressed in Miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 2504.43 | 682.35 | 2600.26 | 2991.53 |

Resultant direction, N. 12° W; Resultant Velocity, 2.50 miles per hour.
Mean velocity 9.38 miles per hour.
Maximum velocity 25.8 miles, from noon to 1 p.m. on the 12th.
Most windy day 20th—Mean velocity 17.11 miles per hour. } Difference 13.14 miles.
Least windy day 18th—Mean velocity 3.97 miles per hour.
Most windy hour, 1 to 2 p.m.—Mean velocity, 11.45 miles per hour. } Difference 3.40 miles.
Least windy hour, 1 to 2 a.m.—Mean velocity, 8.05 miles per hour.

3rd. Very stormy day; hail 7 to 8 a.m.; Raining 8 a.m. to 11 p.m.. and snowing from 11 p.m. to 5 a.m. of 4th.
9th. Solar halo from 9 to 10 a.m.
10th. Foggy during the forenoon.
11th. Solar halo at 7.15 a.m. (imperfect).
12th. Lunar halo from 7 p.m. to midnight.
14th. Raining; freezing as it fell from 7.20 p.m. to 8.30 p.m. of 15th.
15th. Snowing and drifting from 8.30 p.m. to noon of 16th.
19th. Ground Fog at 6 a.m.
20th. Heavy snow storm from 10.10 p.m. to 3 p.m. of 21st.
24th, 25th, 27th, 28th and 29th. Zodiacal light very bright, 7 to 8 p.m.
29th. Very perfect solar halo, 9 to 11 a.m.; sheet lightning in S.W., 10 p.m.

March, 1862, was cold, wet and windy.

## COMPARATIVE TABLE FOR MARCH.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | Excess above Average, (30°1). | Maximum observed. | Minimum observed. | Range. | No. of days. | Inches. | No. of days. | Inches. | Resultant. | | Mean Velocity |
| | | | | | | | | | | Direction. | Velocity. | |
| 1840 | ° 33.3 | + 3.2 | ° 56.9 | ° 8.7 | ° 48.2 | 8 | 1.640 | 8 | ... | ... | ... | ... |
| 1841 | 27.7 | — 2.4 | 53.5 | — 6.9 | 60.4 | 5 | 1.170 | 7 | ... | ... | ... | 0.51lbs |
| 1842 | 35.8 | + 5.7 | 68.7 | 14.9 | 53.8 | 4 | 3.150 | 8 | ... | ... | ... | 0.70 " |
| 1843 | 21.3 | — 8.8 | 38.6 | — 2.8 | 41.4 | 2 | 0.625 | 18 | 25.7 | ... | ... | 1.18 " |
| 1844 | 31.3 | + 1.2 | 50.3 | 9.6 | 40.7 | 8 | 2.470 | 8 | 14.0 | ... | ... | 0.57 " |
| 1845 | 35.4 | + 5.3 | 61.7 | 9.9 | 51.8 | 5 | Imp. | 8 | 2.8 | ... | ... | 0.66 " |
| 1846 | 33.1 | + 3.0 | 49.3 | 7.6 | 41.7 | 9 | 1.965 | 5 | 2.3 | ... | ... | 0.30 " |
| 1847 | 26.2 | — 3.9 | 44.3 | 4.8 | 39.5 | 5 | 0.850 | 6 | 4.2 | ... | ... | 0.71 " |
| 1848 | 28.6 | — 1.5 | 58.9 | 0.9 | 58.0 | 5 | 1.220 | 6 | 9.7 | N 66 W | 2.03 | 5.80ms. |
| 1849 | 33.5 | + 3.4 | 53.4 | 15.4 | 38.0 | 7 | 1.525 | 2 | 2.3 | N 3 W | 1.48 | 5.37 " |
| 1850 | 29.8 | — 0.3 | 46.0 | 6.0 | 40.0 | 2 | 0.745 | 7 | 11.2 | N 52 W | 2.62 | 7.62 " |
| 1851 | 32.4 | + 2.3 | 58.7 | 13.1 | 45.6 | 3 | 0.770 | 9 | 8.8 | N 21 W | 1.93 | 7.65 " |
| 1852 | 27.7 | — 2.4 | 44.8 | — 3.2 | 48.0 | 8 | 3.080 | 12 | 19.5 | N 8 W | 0.71 | 5.81 " |
| 1853 | 30.6 | + 0.5 | 56.3 | — 0.1 | 56.4 | 6 | 1.080 | 8 | 7.1 | N 58 W | 2.60 | 5.96 " |
| 1854 | 30.7 | + 0.6 | 52.8 | 10.4 | 42.4 | 9 | 2.425 | 3 | 2.8 | N 53 W | 3.39 | 8.03 " |
| 1855 | 28.5 | — 1.6 | 48.6 | — 2.9 | 51.5 | 5 | 1.485 | 11 | 18.1 | N 88 W | 4.76 | 9.95 " |
| 1856 | 23.1 | — 7.0 | 39.3 | —13.6 | 52.9 | 0 | 0.000 | 12 | 16.2 | N 71 W | 7.68 | 11.39 " |
| 1857 | 27.8 | — 2.3 | 56.5 | — 3.9 | 60.4 | 4 | 0.335 | 15 | 11.3 | N 63 W | 6.63 | 10.84 " |
| 1858 | 28.4 | — 1.7 | 54.1 | — 5.5 | 59.6 | 10 | 0.917 | 6 | 0.2 | N 58 W | 5.45 | 8.56 " |
| 1859 | 36.3 | + 6.2 | 53.7 | 10.4 | 43.3 | 15 | 4.054 | 8 | 1.0 | N 64 W | 1.96 | 10.39 " |
| 1860 | 34.5 | + 4.4 | 66.4 | 14.2 | 52.2 | 5 | 0.882 | 11 | 2.4 | N 64 W | 7.61 | 12.41 " |
| 1861 | 26.9 | — 3.2 | 43.2 | — 4.1 | 47.3 | 8 | 2.125 | 14 | 7.1 | N 54 W | 4.33 | 10.56 " |
| 1862 | 28.8 | — 1.3 | 41.4 | 9.3 | 32.1 | 8 | 2.560 | 11 | 18.5 | N 12 W | 2.50 | 9.38 " |
| Results to 1861. | 30.13 | ... | 52.55 | 3.77 | 48.78 | 6.0 | 1.548 | 8.7 | 8.77 | N 60 W | 3.63 | 8.60 |
| Diff. for 1862. | —1.34 | ... | — 11.15 | +5.53 | — 16.68 | + 2.0 | + 1.012 | + 2.3 | + 9.73 | ... | ... | +0.78 |

## MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—FEBRUARY, 1862.

(NINE MILES WEST OF MONTREAL.)

### BY CHARLES SMALLWOOD, M. D., LL.D.

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. (tenths) | Rain in Inches. | Snow in Inches. | WEATHER, &c. A cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P. M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 PM | 6 A. M. | 2 P.M. | 10 P.M. | | | | | 6 A. M. | 2 P. M. | 10 P. M. |
| 1 | 30.177 | 29.977 | 29.992 | — 4.0 | 28.4 | 17.4 | .024 | .142 | .087 | .45 | .88 | .84 | N E b E | N E b E | N E b E | 64.70 | 3 0 | ... | 1.10 | Cu. Str. 10. | Snow. | Snow. |
| 2 | 205 | 30.250 | 30.349 | 6.0 | 20.5 | 5.0 | .087 | .075 | .040 | .64 | .70 | .70 | N N W | N | N | 64.80 | 1.5 | ... | ... | Clear. | Cirr. Cum. 4. | Cl'r.Zo.li't br't |
| 3 | 364 | 339 | 197 | —17.1 | 12.1 | 4.9 | .008 | .045 | .032 | .40 | .60 | .60 | E b S | N E b E | N E b E | 18.30 | 1.0 | ... | ... | Clear. | C. C. Str. 8. | Snow. |
| 4 | 139 | 112 | 254 | 4.1 | 14.2 | 4.5 | .038 | .061 | .038 | .73 | .73 | .73 | N E b E | N E b E | S S E | 189.40 | 3.0 | In'p. | 0.57 | Cu. Str. 10. | Cu. Str. 6. | Cu. Str. 10. |
| 5 | 367 | 279 | 258 | —12.1 | 18.9 | 8.1 | .012 | .077 | .048 | .50 | .76 | .77 | S S E | S E | S S E | 2.70 | 2.5 | ... | ... | Hoar Frost. | Clear. | Cl'r.Imp.L.H. |
| 6 | 046 | 29.769 | 29.085 | 1.0 | 24.1 | 17.1 | .032 | .094 | .078 | .70 | .73 | .85 | N E b E | N E b E | N E b E | 119.00 | 4.5 | ... | 0.51 | C. C. Str. 4. | Cu. Str. 10. | Snow. |
| 7 | 29.759 | 862 | 30.069 | 14.1 | 21.0 | 14.8 | .067 | .075 | .051 | .81 | .71 | .65 | W | W N W | W N W | 293.30 | 2.5 | ... | 1.10 | Cu. Str. 10. | Do. 6. | C. C. Str. 4. |
| 8 | 30.098 | 30.096 | 29.988 | 0.0 | 24.0 | 11.0 | .030 | .094 | .048 | .69 | .73 | .69 | N W | N W | N W | 27.20 | 1.5 | ... | ... | Clear. | Do. 2. | Do. 10. L. H. |
| 9 | 29.885 | 29.847 | 994 | 0.0 | 27.0 | 10.3 | .034 | .111 | .049 | .71 | .75 | .70 | S b E | S W | S W | 8.30 | 1.5 | ... | ... | Str. 2. | Clear. | Clear. |
| 10 | 30.008 | 949 | 960 | —17.0 | 15.6 | — 5.4 | .011 | .065 | .030 | .51 | .74 | .82 | N E b E | E b E | E S E | 1.90 | 1.0 | ... | ... | Clear. | Do. | C.C.Str.8. L.C. |
| 11 | 29.840 | 757 | 690 | — 4.7 | 17.0 | 11.0 | .029 | .053 | .067 | .82 | .58 | .79 | N E b E | N E b E | N E b E | 68.00 | 2.0 | ... | ... | C. C. Str. 4. | Cu. Str. 4. | C. Cirr. 4. L.H. |
| 12 | 560 | 644 | 762 | 18.0 | 28.8 | 27.7 | .078 | .127 | .129 | .81 | .76 | .88 | S S E | W | S W | 57.50 | 3 0 | ... | 1.17 | Snow. | C. C. Str. 4 | Cu. Str. 10. |
| 13 | 990 | 951 | 923 | 1.1 | 17.4 | 14.1 | .088 | .047 | .067 | .85 | .50 | .81 | W | S S W | N E b E | 48.80 | 2.0 | ... | 0.51 | Clear. | Cu. Str. 10. | C. C. Str. 10. |
| 14 | 778 | 700 | 30.004 | 16.0 | 24.7 | 4.2 | .080 | .105 | .036 | .91 | .80 | .70 | N | N b W | W b N | 122.10 | 3.0 | ... | 0.77 | Snow. | C. C. Str. 4. | Clear. |
| 15 | 30.115 | 997 | 29.952 | —19.9 | 14.0 | 7.9 | .002 | .051 | .048 | .67 | .63 | .77 | S S E | N E b E | N E b E | 29.30 | 2.0 | ... | ... | Cu. Str. 4. | Cu. Str. 4. | C. Str. 4. S.H. |
| 16 | 106 | 30.300 | 30.382 | 2.0 | 19.0 | 3.8 | .034 | .061 | .028 | .71 | .60 | .57 | W b N | W b N | W b N | 138.40 | 2.0 | ... | ... | Clear. | Clear. | Clear. |
| 17 | 427 | 325 | 190 | — 2.1 | 19.7 | 10.6 | .027 | .081 | .048 | .67 | .77 | .69 | S S E | S S E | N N E | 33.10 | 1.5 | ... | ... | Cirr. Str. 10. | Cu Cir. 4. | Do. |
| 18 | 29.845 | 29.764 | 030 | 12.5 | 34.0 | 25.0 | .060 | .155 | .105 | .80 | .79 | .80 | N E b E | W S W | W b S | 148.10 | 2.0 | ... | 1.14 | Snow. | Cu. Str. 8. | Cl'r.Zo.li't br't |
| 19 | 30.204 | 30.154 | 29.949 | 10.0 | 25.3 | 19.4 | .054 | .105 | .093 | .78 | .80 | .92 | S E | N E b E | N E b E | 46.90 | 2.5 | ... | ... | Cu. Str. 10. | Do. 2. | Cu. Str. 10. |
| 20 | 29.747 | 29.7 4 | 791 | 16.1 | 21.4 | 9.0 | .074 | .090 | .050 | .84 | .78 | .76 | N E b E | W | W | 190.00 | 2.0 | ... | 4.14 | Do. 4. | Do. 4. | Clear. Au. B. |
| 21 | 30.174 | 30.111 | 30.047 | 2.0 | 31.0 | 20.2 | .034 | .166 | .090 | .71 | .78 | .84 | W b S | W S W | W S W | 247.66 | 1.0 | ... | ... | Clear. | Do. 2. | Cu. Str. 10. |
| 22 | 29.882 | 29.814 | 29.084 | 16.0 | 34.2 | 20.0 | .073 | .155 | .097 | .82 | .79 | .92 | E b N | W | S b E | 5.00 | 1.5 | ... | In'p | Cu Str. 10. | Clear. | Clear. |
| 23 | 734 | 679 | 620 | 18.0 | 37.9 | 32.1 | .082 | .177 | .162 | .84 | .80 | .89 | S W | S W | W S W | 28.70 | 1.0 | ... | ... | Do. 8. | Cu. Str. 10. | Cu. Str. 10. |
| 24 | 431 | 324 | 679 | 31.1 | 27.9 | 7.1 | .155 | .117 | .045 | .89 | .77 | .76 | N E b E | N E b E | W | 283.16 | 3.0 | ... | 12.16 | Snow. | Snow. | Do. 10. |
| 25 | 30.103 | 30.152 | 30.206 | —11.1 | 16.4 | 5.5 | .014 | .059 | .046 | .54 | .66 | .87 | W b N | W b N | W b N | 525.20 | 1.5 | ... | ... | Clear. | Clear. | Cl'r.Zo.li't br't |
| 26 | 090 | 29.901 | 29.769 | —10.1 | 25.6 | 2.0 | .017 | .094 | .034 | .57 | .68 | .71 | S S W | S W | S S W | 37.80 | 1.0 | ... | ... | Do. | Do. | Do. |
| 27 | 29.614 | 507 | 578 | 4.0 | 20.0 | 17.4 | .038 | .081 | .072 | .75 | .77 | .75 | N E b E | W S W | W S W | 124.59 | 2.0 | ... | 1.10 | Cu. Str. 10. | Snow. | Snow. |
| 28 | 490 | 474 | 513 | 14.0 | 28.4 | 22.0 | .067 | .123 | .101 | .81 | .82 | .86 | W S W | W S W | W | 241.60 | 2.0 | ... | 3.50 | Snow. | Do. | Cu. Str. 10. |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |

## MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—MARCH, 1862.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M.D., LL.D.

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. t'nths | Rain in inches. | Snow in inches. | Weather, &c. A Cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | | | | | 6 A.M. | 2 P.M. | 10 P.M. |
| 1 | 29.679 | 29.700 | 29.791 | 11.1 | 23.0 | 19.1 | .057 | .095 | .077 | .79 | .79 | .77 | W S W | W | W | 302.70 | 2.5 | ... | 0.75 | Snow. | C. C. Str. 4. | Cirr. Str. 10. |
| 2 | 929 | 942 | 952 | 17.1 | 32.1 | 15.0 | 078 | 143 | 161 | 87 | 79 | 73 | W b S | W | W | 76.70 | 1.5 | ... | ... | Cirr. Cum. 4. | Clear. | Clear. Z. l't br't |
| 3 | 920 | 814 | 742 | — 3.1 | 32.1 | 25.6 | 025 | 143 | 111 | 66 | 79 | 81 | ... | N E b E | N E b E | 0.70 | 2.5 | ... | ... | Clear. | C. C. Str. 4. | Cu. Str. 10. |
| 4 | 318 | 420 | 507 | 33.1 | 34.6 | 24.6 | 168 | 162 | 105 | 89 | 84 | 80 | N E b E | N E b E | N E b E | 363.50 | 3.5 | ... | 1.85 | Snow. | Cu. Str. 10. | Snow. |
| 5 | 498 | 500 | 504 | 23.0 | 31.4 | 24.1 | 106 | 130 | 111 | 86 | 74 | 86 | W S W | W S W | W b N | 330.00 | 3.5 | ... | 5.00 | Do. | Snow. | Cirr. Str. 10. |
| 6 | 511 | 574 | 601 | 22.1 | 41.0 | 28.0 | 098 | 212 | 135 | 78 | 82 | 86 | W S W | S W | W b N | 119.70 | 3.5 | ... | 1.09 | Cu. Str. 10. | Cu. Str. 10. | Snow. |
| 7 | 662 | 741 | 779 | 20.0 | 50.1 | 35.2 | 091 | 283 | 182 | 83 | 78 | 89 | W b S | W S W | W | 34.10 | 2.0 | ... | ... | Fog. | Clear. | Cirr. Str. 2. |
| 8 | 823 | 947 | 30.051 | 26.2 | 56.2 | 34.2 | 126 | 391 | 160 | 86 | 87 | 86 | W b S | S W | S W | 10.40 | 1.5 | ... | ... | Cirr. Str. 8. | Do. | Clear. |
| 9 | 30.152 | 30.147 | 062 | 24.1 | 49.7 | 34.2 | 094 | 265 | 155 | 76 | 74 | 80 | S W | W | S W | 10.60 | 1.5 | ... | ... | Clear. | Do. | C. C. Str. 10. |
| 10 | 29.790 | 29.592 | 29.417 | 33.1 | 36.7 | 34.7 | 168 | 164 | 169 | 89 | 76 | 84 | S b E | S b E | S E | 203.60 | 3.5 | 0.581 | ... | Rain. | Rain. | Rain. |
| 11 | 800 | 897 | 901 | 30.0 | 36.4 | 30.0 | 130 | 170 | 132 | 78 | 80 | 79 | S E | N W | S W | 242.50 | 3.5 | ... | ... | Cu. Str. 4. | C. C. Str. 4. | C. Cum. 4. L.H. |
| 12 | 802 | 789 | 30.064 | 21.4 | 39.7 | 21.3 | 105 | 188 | 095 | 80 | 77 | 79 | W b S | N b W | N N E | 201.10 | 2.5 | ... | 0.40 | Cirr. 4. | Snow. | Str. 2. |
| 13 | 30.211 | 30.279 | 243 | 6.4 | 30.3 | 26.1 | 040 | 124 | 120 | 70 | 73 | 86 | W S W | S S W | N E b E | 44.20 | 1.5 | ... | 0.09 | Clear. | Cirr. Cu. 4. | Snow. |
| 14 | 057 | 030 | 057 | 25.1 | 30.4 | 23.4 | 117 | 146 | 106 | 88 | 87 | 86 | N E b E | N E b E | N E b E | 200.50 | 3.5 | ... | 0.63 | Snow. | Snow. | Cu. Str. 10. |
| 15 | 29.934 | 29.817 | 29.749 | 24.2 | 30.4 | 23.4 | 111 | 142 | 100 | 86 | 84 | 79 | N E b E | N E b E | N E b E | 326.90 | 4.0 | ... | 3.98 | Cu. Str. 10. | Do. | Do. 10. |
| 16 | 609 | 579 | 600 | 21.1 | 27.0 | 26.1 | 085 | 105 | 117 | 78 | 70 | 82 | N E b E | N E b E | N E b E | 641.40 | 2.0 | ... | ... | Do. 10. | Cu. Str. 10. | Snow. |
| 17 | 647 | 727 | 734 | 24.1 | 27.9 | 24.2 | 111 | 117 | 094 | 76 | 74 | 87 | N E b E | N E b E | N E b E | 403.60 | 3.0 | ... | 1.47 | Do. 10. | Slight Snow. | Slight Snow. |
| 18 | 999 | 30.074 | 30.027 | 25.1 | 45.6 | 24.3 | 117 | 245 | 094 | 87 | 80 | 73 | N E b E | S S W | N N E | 6.90 | 1.5 | ... | 0.74 | C. C. Str. 4. | Clear. | Str. 4. |
| 19 | 30.079 | 29.977 | 054 | 6.1 | 39.0 | 19.0 | 029 | 195 | 072 | 51 | 82 | 70 | N E b E | W S W | E S E | 24.70 | 1.0 | ... | ... | Str. 4. | Cu. Str. 4. | Clear. Z. l't br't |
| 20 | 29.977 | 997 | 002 | 7.4 | 43.0 | 34.2 | 040 | 209 | 162 | 64 | 75 | 80 | S S W | S | E N E | 0.00 | 1.0 | ... | ... | Clear. | Clear. | Clear. |
| 21 | 834 | 730 | 29.648 | 20.1 | 34.6 | 32.0 | 091 | 169 | 162 | 85 | 84 | 89 | N N E | N E b E | S E | 79.30 | 2.5 | ... | 1.75 | Cu. Str. 10. | Snow. | Snow. |
| 22 | 440 | 437 | 432 | 30.0 | 36.4 | 35.4 | 136 | 170 | 189 | 83 | 80 | 92 | N E b E | N E b E | N E b E | 1.10 | 2.0 | ... | ... | Do. 4. | Cu. Str. 4. | Sleet. |
| 23 | 519 | 574 | 637 | 33.4 | 50.0 | 34.2 | 162 | 283 | 162 | 84 | 78 | 84 | S E b E | S E | S W | 0.30 | 1.8 | ... | ... | Do. 10. | C. C. Str. 10. | Nimb. 10. |
| 24 | 496 | 644 | 630 | 32.4 | 42.6 | 32.0 | 175 | 194 | 143 | 89 | 74 | 79 | W | S W | W S W | 0.10 | 2.5 | 0.040 | ... | C. C. Str 8. | Cu. Str. 4. | Clear. |
| 25 | 727 | 751 | 804 | 31.1 | 36.0 | 28.8 | 140 | 156 | 111 | 80 | 75 | 71 | W | W S W | W | 183.20 | 1.0 | ... | ... | Cu. Str. 2. | Clear. | C. C. Str. 8. |
| 26 | 807 | 900 | 952 | 28.4 | 42.7 | 23.0 | 129 | 193 | 087 | 83 | 71 | 72 | S W | S S W | W | 159.00 | 1.0 | ... | ... | Clear. | Do. | Clear. Au. B. |
| 27 | 927 | 841 | 960 | 14.1 | 52.0 | 35.0 | 051 | 315 | 183 | 63 | 83 | 90 | W b S | S S W | S W | 50.70 | 1.0 | ... | ... | Do. | Do. | Cu. Str. 4. |
| 28 | 824 | 917 | 30.050 | 17.1 | 32.9 | 26.2 | 068 | 137 | 105 | 75 | 73 | 75 | W | N E b E | N E | 314.70 | 1.5 | ... | ... | C. C. Str. 4. | Do. | Clear. Z. l't br't |
| 29 | 30.124 | 30.121 | 120 | 15.7 | 42.4 | 32.4 | 065 | 215 | 143 | 74 | 79 | 79 | W S W | W S W | W S W | 22.20 | 1.0 | ... | ... | Clear. | Do. | Clear. |
| 30 | 097 | 109 | 29.917 | 18.7 | 48.1 | 32.1 | 077 | 234 | 143 | 76 | 80 | 79 | W S W | W S W | S S E | 4.90 | 1.0 | ... | ... | Do. | C. Cirr. 4. | Do. |
| 31 | 29.821 | 29.820 | 924 | 32.6 | 60.2 | 34.2 | 175 | 203 | 162 | 94 | 82 | 84 | S S E | S | E b N | 207.20 | 2.5 | Inap. | Inap. | Snow. | Sleet. | Cu. Str. 10. |

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR FEBRUARY, 1862.

| | | |
|---|---|---|
| Barometer | Highest, the 17th day | 30.427 |
| | Lowest, the 6th day | 29.085 |
| | Monthly Mean | 29.943 |
| | Monthly Range | 1.342 |
| Thermometer | Highest, the 23rd day | 37°.9 |
| | Lowest, the 15th day | -19°.9 |
| | Monthly Mean | 13.°52 |
| | Monthly Range | 57°.8 |
| Greatest intensity of the Sun's Rays | | 78°.8 |
| Lowest Point of Terrestrial Radiation | | -20°.4 |
| Mean of Humidity | | .740 |

Rain fell on 1 day, inappreciable.

Snow fell on 13 days amounting to 27.77 inches. It was snowing 101 hours and 44 minutes.

Most prevalent wind, the N. E. by E.

Least prevalent wind, the E. by S.

Most windy day, the 25th; mean miles per hour, 20.88.

Least windy day, the 5th; mean miles per hour, 0.11

Aurora Borealis visible on 1 night.

3 Lunar Haloes and 1 Corona seen.

1 Solar Halo.

Zodiacal light bright and well defined.

The Electrical state of the Atmosphere has indicated moderate intensity.

Crows first seen on the 10th.

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## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR MARCH, 1862.

| | | |
|---|---|---|
| Barometer | Highest, the 13th day | 30.279 |
| | Lowest, the 4th day | 29.318 |
| | Monthly Mean | 29.858 |
| | Monthly Range | 0.961 |
| Thermometer | Highest, the 27th day | 52°0 |
| | Lowest, the 3rd day | - 4°1 |
| | Monthly Mean | 29°29 |
| | Monthly Range | 56°1 |
| Greatest intensity of the Sun's rays | | 73°1 |
| Lowest point of Terrestrial Radiation | | - 5°7 |
| Mean of Humidity | | .793 |

Rain fell on 4 days, amounting to 0.621 inches; it was raining 34 hours.

Snow fell on 12 days, amounting to 17.75 inches; it was snowing 128 hours and 50 minutes.

Most prevalent wind, N. E. b E.

Least prevalent wind, E.

Most windy day, the 16th day; mean miles per hour, 26.74.

Least windy day, the 20th day: Calm.

Aurora Borealis visible on 2 nights.

Solar Halo visible on 1 day.

Lunar Halo visible on 1 night.

Zodiacal light frequently very bright.

The Electrical state of the Atmosphere has indicated feeble intensity.

PROPERTY OF
AMERICAN A[illegible]
FOR THE [illegible]
OF [illegible]

THE

# CANADIAN JOURNAL

OF

# INDUSTRY, SCIENCE, AND ART:

CONDUCTED BY

THE EDITING COMMITTEE OF THE CANADIAN INSTITUTE.

NEW SERIES. No. XL.

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# CANADIAN INSTITUTE.

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THE CANADIAN JOURNAL.

NEW SERIES.

No. XL.—JULY, 1862.

# OBSERVATIONS ACCOMPANYING THE EXHIBITION OF A SPECIMEN OF "*SULA BASSANA*," (THE SOLAN GOOSE OR GANNETT), LATELY OBTAINED AT OSHAWA, C.W., AND BELONGING TO THE MUSEUM OF THE UNIVERSITY OF TORONTO.

BY THE REV. WILLIAM HINCKS, F.L.S., ETC.,
PROFESSOR OF NATURAL HISTORY IN UNIVERSITY COLLEGE, TORONTO.

*Read before the Canadian Institute, February 8th,* 1862.

The specimen which I have the pleasure of bringing under the notice of the Canadian Institute this evening, may be accounted a curiosity in this part of the country, as the bird rarely leaves the neighbourhood of the sea-coast; and when it does so, can only be regarded as an accidental wanderer. The specimen, which is a female, agrees well with the descriptions and figures of the European Gannett; and having been unable to meet with any definite character of the supposed North American species, *Sula Americana,* I cannot judge whether it is really distinct or whether our individual belongs to it; but considering the tendency manifested by some naturalists to find or make different species for different regions, I somewhat incline to number this among the imaginary ones.

The habits of the Solan goose, especially at its breeding time, have been so fully described in popular works, that I shall not dwell on the subject; but its systematic position and affinities may be worthy of some consideration, and will give me the opportunity of offering some details illustrative of views of classification, of which a general outline has been already submitted to you.

The genus *Sula* is referred to the family *Pelecanidae*, among the *Natatores* or swimming-birds; and this family is distinguished by the union of the hind toe with the others in a single membrane, great power of wing, generally short legs, the nostrils being slits with a scarcely perceptible aperture, the skin of the throat generally more or less extensible, the tongue small, and the gizzard united with the stomach. The admitted generic forms in the family are *Atagen*, the frigate-birds—(amidst much confusion about names, I have adopted those of Dr. Geo. Gray, as given in the *Genera of Birds*); *Phaeton*, the tropic bird; *Sula*, the gannett; *Graculus*, the cormorant; *Pelecanus*, the pelican; and *Plotus*, the snake-bird. These genera are not rich in species, and the family is a small one, and remarkably deviative in its habits from the mass of *Natatorial* birds; yet such striking peculiarities are observable among the genera, that Dr. G. Gray has placed them in three sub-families, and we may see reason for extending this sub-division. But before we proceed with the analysis of the *Pelecanidae*, I may perhaps be indulged in a few observations on classification generally, and especially on the best treatment of the great class of Birds, designed in illustration and confirmation of a method already submitted to the Institute.

It is well known, that according to the views of McLeay and Swainson, the plan of creation in every different group of organized beings, is sub-division into three leading,—or, since one of them is itself again divided,—into five secondary groups, which are characterized as typical, sub-typical, and aberrant—the latter itself exhibiting three variations. In applying this scheme to the various parts of organised nature, so much knowledge and ingenuity were displayed, and there were so many striking instances in which a satisfactory natural grouping seemed to result, that many were led to believe that the secret of natural classification was detected, and that in order to obtain a perfect system we had only diligently to work out in the various parts of nature, the circles of three or five groups, with their sub-divisions and their analogies, in which all truths respecting relationship were supposed to be contained.

Individually,—though deeply interested in such inquiries,—I was never led to adopt the quinary or any kindred system. I was often forcibly struck by the apparent truth and beauty of the combinations produced; but I also fancied I met with some manifest errors, some forcing of objects into a place, and some far-fetched analogies. I was, besides, much influenced by general arguments on the subject, which, whatever be their true weight, seem to have prevailed with the great majority of naturalists. And yet, after twelve years of constant attention to the formation, arrangement, and care of museums, during which it has been a special object with me to make the specimens instructive, by placing them in natural groups, I find myself compelled by my experience to the recognition of the very kind of collections of families usually five in number, and conveniently represented as forming a circle, for which Mr. Swainson contended, and I find it impossible to resist being impressed by the remarkable analogies of corresponding groups belonging to different circles. Reflecting much on the nature of these relations, I have gradually formed a theory which seems to me to connect all the facts, and to afford all the explanation of them which we can expect. I conceive that every distinct type of animal structure is capable of being worked out with a larger proportional development of the organs of sense and motion; or, on the other hand, of those of nutrition: and under the former head the development may take the direction of power and ferocity, of greater elevation, and completeness of structure; or that of grace and activity, with general adaptation, where it is at all consistent with the plan of nature, to an aerial or arboreal life. Under the second head, the higher form of peculiarly nutritive development will be known by a well-balanced figure, with a somewhat full habit of body, comparatively quiet and gentle manners, in lower forms approaching sluggishness, and the use chiefly of food which needs not to be obtained by violence or energetic effort. But under this general head there are two other remarkable modifications: one for anomalous—often in some way elongated—forms; and one for the lowest structure consistent with the general type, very often connected with aquatic life. These are to be understood as tendencies of development, and we affirm that they include all the distinct tendencies that are observable in nature; or, at least, that any others that can be pointed out are only occasional accompaniments of some of these.

One other observation, entirely overlooked, I believe, by Mr. Swainson and his followers, is in my estimation of very high importance for attaining to a good and natural classification. It is that occasionally, perhaps frequently, under one general type of structure we may find not only the five tendencies of development as above explained, but these exhibited in connection with several different well-marked degrees of development. Thus in the highest class, that which peculiarly expresses power and elevation of structure, of the sub-kingdom or branch Vertebrata—the class Mammalia—we have four circles expressing degrees of development, in each of which—excepting the highest, which is occupied by man alone—we find manifestations of all the five tendencies of development in natural groups, which are here called Orders; and in the class Birds, which in the same sub-kingdom expresses the tendency to activity and grace, with prevailing adaptation to aerial or arboreal life, we obtain the clearest idea of the affinities, by placing in the centre the most especially typical groups of small birds forming the great families of the warblers and finches; surrounding these by a circle of five sub-orders of Insessorial birds; and again placing outside of them five more deviative forms exhibiting greater extremes of the tendencies of development already displayed in the inner circles. The great mass of birds forming the two inner circles, constitute the order Insessores, or perching birds, in technical systems; whilst the outer circle embraces Raptores, birds of prey; Scansores, climbing birds; Rasores, poultry and game birds, with which are connected the ostrich tribe, sometimes regarded, very needlessly, as a separate order; Grallatores, stilted or wading birds; and Natatores, swimming birds,—the latter being the lowest group of birds, and analogous with the Cetacea among mammalia.

With due attention to these concentric circles expressing varying degrees of development of the same type, I am disposed to maintain that the several tendencies pointed out will bring before us all really distinct families in every part of the animal kingdom excepting that in the lowest divisions, as might have been anticipated from reasoning, the lower forms can have no place, so that we recognise only three tendencies instead of five; and that in various parts of the general system there will be cases in which, from our ignorance of certain existing forms, or from the incompatibility of a certain tendency of development with a particular type, breaks will be found interfering with the perfect symmetry of our plan.

What Mr. Swainson intends by naming the groups which make up each circle, *typical*, *sub-typical*, and *aberrant*, is that one of these groups will be found to be especially characterized by those peculiarities of structure or mode of life which belong to the whole circle, so as to display its distinctions in their most striking form, and this one is generally found to be the most numerous in species: another group will approach this both in its relations to the type and in number of species, but will exhibit special features in analogy with some other circle, so as to show the characters of the type differently modified. The remaining groups, with a preponderance of the characters of the type, unite such deviations expressing their own peculiar plan of development, as make them appear like transitional forms leading towards other circles. Mr. Swainson placed what he took to be the typical group first, then the sub-typical, and after these the aberrant; the consequence of which is, that he places analogous forms in different positions in the different circles. I by no means deny that in each circle there is one group whose plan of development is specially adapted to the type, and which thence displays most abundance and variety of species; this, indeed, logically follows from my general theory; but as I always place the representatives of the same tendencies of development in the same position in each circle, it must follow that the typical groups will have various situations in the different circles, according to the characteristic tendency in each, whilst the analogical groups will always be found in the same position, and this I regard as a very important advantage of my plan.

The preceding remarks will be sufficient on the present occasion, as illustrating my idea of a natural system in the animal kingdom, and I have had occasion to enumerate the great divisions of the class Birds, with their mutual relations. It has been stated that the family *Pelecanidae*, with which we are now more immediately concerned, belongs to the order *Natatores* (swimming-birds), which may upon the whole be regarded as containing the lowest forms of bird life. We will first inquire how many really distinct primary families are found in this order, and further, how far their structure and habits correspond to the notion of their representing in this circle, by modifications of its general type, tendencies of development which have been already indicated in the orders themselves, and which, according to our theory, we might expect to see exhibited throughout the animal kingdom. It is only by the more modern systematists that families and sub-families have been interposed between the order and the genera. Cuvier and Vander Hoeven each admit *four* great families of *Natatores, Palmipedes* or *Anseres,* as the order has been named by different writers. Cuvier gives them as the Divers (*Brachypteres*); the Gulls and their allies including the Petrels (*Longipennes*); our *Pelecanidae,* called by Cuvier *Totipalmati:* and the Ducks and Geese (*Lamellirostres.*)

Vander Hoeven, with a slight difference in the order of the series and in the naming, gives: 1. *Brevipennes* or *Urinatores;* 2. Ducks (*Lamelloso-dentati*); 3. *Steganopodes* (Illiger's name for the *Totipalmati* of Cuvier), the Pelicans; and, 4. *Longipennes,* the Gulls, Terns, and Petrels.

Dr. George Gray, following Vigors, Swainson, and others, separates the Auks and Penguins (his family *Alcidae*) from the Divers, *Colymbidae.* Prince Bonaparte considers the Penguins, *Spheniscidae,* as being also distinct; and he, as well as Gray, separates the *Procellaridae* from the Gulls and Sea Swallows. Thus Prince Bonaparte receives seven, Dr. Gray six, Swainson five, and other great authorities only four principal families of *Natatores.* In my view of the subject, the difference between *Alcidae* and *Colymbidae* is well established; but *Spheniscidae* (the Auks of the southern hemisphere) are to be accounted only as a sub-family; whilst I think both the Petrels and Terns only sub-families of *Laridae.*

It appears to me, in short, that, putting his theory out of view, Mr. Swainson has here exercised a wise discretion, recognizing a manifest distinction of structure and habits, but refusing, where there are very strong points of general resemblance, to make minor differences a pretence for multiplying families. Let us now ask whether we can perceive among the families of *Natatores* or swimming birds, any thing like representation of the several tendencies of development which have been pointed out as occurring in the various divisions of the animal kingdom.

The character of power and of the highest development suited to the type is in the outer circle of birds exhibited by the order of *Raptores,* the birds of prey. We have then to observe whether any of our *Natatorial* families displays characteristics analogous with these birds. We might look especially to strength of wing, rapidity of flight, taking the prey by a pounce or swoop, and being less decidedly aquatic in habits than the rest of the order—at least with some exception in the family representing the second tendency. We can hardly fail to be led in pursuit of such characters to the *Pelecanidae*, which are remarkable for the length and power of their wings, swim less than any of the other birds organised for aquatic life, and seize their prey either like the *Atagen*, or Frigate bird (the most peculiarly *Raptorial* of the family), by a swoop from the surface of the water, or, like the Gannett and Pelican, by a sudden stroke from above. If we inquire what family of swimming birds deviates least in figure and flight from the most typical birds, forming a link of connection between the *Insessorial* and *Natatorial* orders, and impressing us with the activity and gracefulness of its movements and its union of aerial with aquatic modes of life, we immediately think of *Laridae*—the Gulls, Terns, and Petrels as certainly occupying the second place. It needs no array of evidence to prove that *Anatidae*, including swans, geese, and ducks in all their variety, represent the nutritive tendency, and are analogous with the poultry among the orders of birds. They constitute the largest and most characteristic of the *Natatorial* groups —Mr. Swainson's typical family. The lengthened bill and neck, generally elongated figure, and frequently anomalous feet of the Divers (*Colymbidae*), point out their position as representing the fourth tendency in analogy with wading birds ; and finally, the entire unfitness for living out of water or moving much in any other element, with the manifestly low structure as compared with the rest of the order, and with almost all other birds, proves that we are right in assigning the fifth place to *Alcidae*, the Auks and Penguins.

It remains to be considered whether, even in the comparatively small and deviative family of the *Pelicanidae*, an examination of the generic forms will not enable us to mark out sub-families however limited in number of species, again indicating the same tendencies. And here I would name the Frigate birds (*Atageninae*) as displaying the *raptorial* tendency ; the *Phaetoninae* or Tropic birds, whose graceful figure, little removed from that of *Insessorial* birds, has caused them to be placed among the Gulls, notwithstanding the beak and the feet showing its connection with the Pelicans, will naturally take the second place.

The bird which has given occasion to these observations, with the larger nearly-related genus *Graculus*, the Cormorant (*Phalacrocorax* and *Carbo* of different authors), forming the sub-family *Sulinae,* may occupy the third position; *Plotinæ,* characterized by the long flexible neck, which has obtained for the birds the name of "snake birds," take the fourth place; and the anomalous Pelicans themselves, *Pelecanidae,* seem fitly to fill the fifth.

What has thus been brought forward in respect to one order and one family is an example of what I conceive to be the proper treatment of every division of the animal kingdom, and I cannot but feel that it presents to our notice at the same time the affinities and analogies of natural objects with a clearness and effect of which we find the want in the methods more commonly employed. It is, of course, only from a number of instances appearing to yield truly natural results, and all plainly displaying the corresponding analogies, that any general conclusion can be drawn in favour of the system, and my confidence in it arises from my belief that I can produce such instances, and from the uniformity with which I have found the general idea in my mind assist me in the solution of difficult questions, and in improving the arrangement of tribes which seemed to me to have been left by others in the most unsatisfactory condition.

# SCIENCE IN RUPERT'S LAND.

COMMUNICATED BY DANIEL WILSON, LL.D.

The present year has witnessed, in the founding of the Institute of Rupert's Land, a remarkably interesting illustration of the changes which are slowly but surely revolutionising this vast continent; and giving evidence of an intellectual dawn which heralds the period when states and empires of the great northwest are to claim their place in the world's commonwealth of nations. The meeting for the formation of the Institute was held on the 12th of February, in the Court-room of Upper Fort Garry, where the Lord Bishop of Rupert's Land, as president of the Institute, delivered the opening address. After alluding to the Universities and other seats of learning in England, and to the influence they had exercised in fostering science his Lordship referred to the striking contrast presented to the natives and colonists of the Red River Settlement in their field of labour. But, while, as he remarked, all might feel inclined to acknowledge the Universities and Colleges of Britain, and of Europe at large, as the nurseries of science, where its fitting guardians were to be looked for; and to recognise that its progress was to be anticipated under their fostering care: "Have we," asked the learned prelate, speaking in the name of his Red River auditors, "Have we any field for such pursuits? Does our land, in its present state, offer scope and opportunity for anything of the kind proposed? To this our reply is, others think so. Only the summer before last, a party of travellers passed through the Settlement and proceeded northward,—not lured by the prospect of gain; not attracted by any dazzling commercial speculation; yet fired, as was obvious to all who met them, with no less ardent enthusiasm, and eager to overcome every obstacle with this one object at heart. They wished, as you will recollect, to gain a spot from which, as they had calculated, they might obtain the best view of a marvellous phenomenon in the heavens.* Theirs was surely a praiseworthy ambition; and you saw in them, that science has her devoted followers, ready to encounter on her behalf any difficulties. The very same summer, I found on my arrival at Moose, that a traveller had preceded me,† and gone along the shores of the East Main, sent under the auspices of the Smithsonian Institution chiefly as an Oologist or collector of the eggs of wild birds. And we have yet another‡ in our territory on the Mackenzie River, the Youcon, or the shores of the Arctic Sea, who has spent two or three winters in those solitary regions, gathering specimens of the insects of the land for the same scientific body. Besides those, there have been two or three fully organized exploratory expeditions: that of the British Government under Capts. Pallisser and Blakiston, with its Naturalist, Geologist and Astronomer; and that of the Canadian Government under Mr. Dawson and Professor Hind, with its reports carefully drawn up and digested, and the detailed results submitted to the observation of the public. Such is apparently the judgment of others: they survey the land and look into its treasures and find something to reward their labors. Shall we, however, think only of strangers; have we no spirit of research among ourselves? There is one present,* who n the midst of a laborious life, has often stolen hours from rest, looking with curious eye into the mysteries of nature, scrutinizing the beautiful texture of the insect's wing, or minutely examining the wild flower of the Prairie or the Bay. Another too there is, holding the same rank in the Hon. Company's service, whose best energies have, for many years, been given to the cause; who has pursued it unintermittingly, whether at Martin's Falls, at Norway House, or as I last saw him, full of the one topic, on the shores of Lake Superior. The name of Mr. Barnston is not unknown in Britain as that of a scientific collector, and his valuable contribution of insects from this country may be seen in the Entomological Department of the British Museum."

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* The Astronomical Expedition to take observations of the Solar Eclipse of July 18th, 1860.

† Mr. Dressler.

‡ Mr. R. Kennicott.

Dr. Schultz, in addressing the meeting, sought to indicate the field of scientific labour to be overtaken by the new Institute, and to stimulate its members to a hearty co-operation by further reference to scientific labours already successfully carried out in their midst:—"First," he remarked, "we shall be expected to give accurate scientific information on the Botany, Zoology, Geology, Ethnology, Meteorology, and Physical Geography of this country; to collect and exchange specimens with Societies of a like character, to publish the results of our researches, to give lists of specimens collected, and to correct the maps of this country. Here, we shall be expected to improve the condition of the country by encouraging the Arts and Manufactures, making experiments on the native plants, introducing new plants and seeds; by establishing a Library and Museum, and if assisted, an Observatory; and to answer those expectations, what have we done; what are we doing; and what can we do? In the '*Fauna Boreali Americani*' I note the following passage by Sir John Richardson: 'Science is indebted to the exertions of the Hudson Bay Company for all that is known of the Ornithology of the American fur countries,' and he goes on to specify the labours and contributions of many officers of that company in this country—Mr. Light, Mr. Islam, Mr. Graham, Mr. Martin, Mr. Hutchins (who made valuable contributions on the habits of the northern birds), Mr. David Douglas, and others. This is what has been done in Ornithology alone; and Zoology, Botany, Meteorology, and Geology are also largely indebted to those and other observers. For what we are doing now, we need only say that year after year we find in the Reports of the Smithsonian Institution acknowledgments of valuable contributions from Governor Mactavish; and other Societies and individuals in Britain and Canada are also indebted for specimens to this indefatigable collector. Mr. Donald Gunn, a well known collector and observer; Mr. Bernard Ross, whose name is well known in Britain and Canada; Mr. Ross the well known Historian of the Colony; Mr. Bannatyne, who made valuable collections for Professor Agassiz, and many others may in like manner be referred to. And now, what may we do? First, we have advantages for collecting possessed by no other Society of a like character. The most unscientific among us while travelling could note down the appearance of the country, the character of the soil, the prevailing timber trees, the width, depth, and course of the rivers; could chip off pieces of the rock, pick up fossils, press a plant, or preserve a skin, and thus make valuable contributions to our Institute. As to the industry of those accustomed to collect, I need only direct your attention to the table before us, where you will notice specimens from the neighbourhood of the Rocky Mountains, from the north shore of Lake Superior, from the Missouri River, from the Athabasca, Great Slave Lake, Mackenzie River, and even from the shores of the Icy Sea. Those beautiful birds are from the Ornithological collections of Mr. Bannatyne; the fossils from the Geological collection of the Ven. Archdeacon Hunter, procured by himself during his residence near the Arctic Circle; others from Lake Superior, kindly given by the Lord Bishop; the Entomological specimens are from Governor Mactavish; and the collection of curiosities are samples of the workmanship of the Esquimaux, Chippewyans, Sioux, and other Indian tribes; and I am encouraged when I see those indefatigable collectors here to-day, willing not only to give their valuable collections to the museum, but to become active working members of this Institute, and to give us from time to time the results of their observation and research."

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* W. Mactavish, Governor of Assiniboia, whose valuable collections of Natural History received the thanks and acknowledgments of the Smithsonian Institution in 1861.

It is impossible to look upon the foundation of such an Institute, without feeling that here, on the remote confines of civilization, we witness the establishment of an outpost of science, from whence we may look for returns of the highest interest and value. It is situated in the very midst of the diverse Indian tribes of the North West, still in a state of nature; and its President accordingly remarks on this department of investigation:—

"With the Indian tribes and all their ramifications and subdivisions, we shall invite discussion on Ethnology; with the diversified tongues and dialects which these tribes speak, philology and comparative grammar will claim attention; whilst with the vast and varied surface of the continent, and its only partially explored northern boundary, physical geography will naturally prove a subject of absorbing interest to all."

The Institute of Rupert's Land, thus happily inaugurated, includes among its members and correspondents educated men both of the resident clergy, and the officers of the Hudson's Bay Company, stationed at many important points over the vast country ranging from the Pacific to Lake Superior and towards the Arctic Sea. A great and still unexplored field invites their labours; and there is no department of science which may not be largely benefited by their combined exertions. There is also another class of labourers, to whom science already owes much, and from whose wisely directed co-operation more may be anticipated. "Missionaries," says a recent Christian reviewer, "ought to be the pioneers and promoters of science, hand in hand with the Gospel, throughout the world. In fact they have been so. And we believe it will be found on close inquiry, that the most efficient labourers in the purely spiritual field, have been on the whole, or on the average of numbers, those who also have done most to shed a brilliant lustre upon the missionary character and name in the fields of natural and scientific inquiries and studies."

An interesting illustration of what may be looked for from this class of labourers is furnished by a communication from the Rev. W. W. Kirkby, a missionary of the Church of England, transmitted by Mr. Ross to the New Institute of the North West, from which some extracts will be found to embody observations of considerable value.

The river Youcon is the most westerly of the great rivers emptying into the Arctic Ocean. It rises in the Hudson's Bay Territory, but its principal course is through Russian America, where, after receiving the waters of the Porcupine River, it unites with the Colville, and flows nearly due north in longitude 150° W. into the Arctic Ocean. To a portion of the region drained by this great water system, Mr. Kirkby recently directed his attention, and thus details some of the incidents of his journey, of a nature most calculated to prove interesting to the general reader:—

"I left home on the 2nd of May, in a canoe paddled by a couple of Indians belonging to my mission. We followed the ice down the noble McKenzie, staying awhile with Indians wherever we met them; and remained three or four days at each of the Forts along the route. On the 11th of June I left the zone in which my life had hitherto been passed, and entered the less genial *arctic* one. Then, however, it was pleasant enough. The immense masses of ice piled on each side of the river sufficiently cooled the atmosphere to make travelling enjoyable. The sun shed upon us the comfort of light nearly the whole twenty-four hours, and as we advanced further northward he did not leave us at all.

"Between Point Separation and Peel's River, we met several parties of Esquimaux, all of whom, from their theivish propensities, gave us a great deal of trouble, and very glad were we to escape out of their hands without loss or injury. They are a fine looking race of people, and from their general habits and appearance, I imagine them to be much more intelligent than the Indians. If proof were wanting, I think we have it in a girl brought from the Coast, little more than three years ago, who now speaks and reads the English language with considerable accuracy. The men are tall, active, and remarkably strong, many of them having a profusion of whiskers and beard. The women are rather short, but comparatively fair, and possess very regular and by no means badly formed features. The females have a very singular practice of periodically cutting the hair from the crown of their husband's head (leaving a bare place precisely like the tonsure of a Roman Catholic priest), and fastening the spoil to their own, they wear it in bunches on each side of their face, and on the top of their head, something in the manner of the Japanese who recently visited the United States. This custom, as may be imagined, by no means improves either their figure or appearance, and as they advance in life, the bundles must become uncomfortably large. A benevolent old lady was most urgent on me to partake of a slice of blubber; but I need hardly say that a sense of taste caused me to decline her hospitality. Both sexes are inveterate smokers. Their pipes, which they manufacture themselves, are made principally of copper. In shape, the bowl is very like a reel used for cotton, and the hole through the centre is as large as the aperture for holding the tobacco. This they fill, and when lighted, they do not allow a single whiff to escape, but swallow it, withholding respiration until the pipe is finished. The effect of this upon their nervous system is great. They often fall on the ground completely exhausted, and for a few minutes tremble like an aspen leaf. The heavy beards of the men, and the fair complexions of all, astonished my Indians greatly, and in their surprise they called them 'Mannoli Conde,' like the white people. They were all exceedingly well dressed in deer-skin clothing, with the hair outside, which being new, and nicely ornamented with white fur, gave them a clean and very comfortable appearance. Their little Kiyachs were beautifully made, and the men were armed with deadly-looking knives, spears and arrows, all of their own manufacture. The Indians are in great dread of them; and so afraid of my safety were two different parties that I met on my way down, that a man from each of them, who could speak a little Eskimos, volunteered to accompany me, and their freely rendered services proved invaluable to me. Poor fellows, they will never see this; but I cannot refrain from paying them here my tribute of gratitude and thanks.

"At Peel's River I met with a large number of Loucheux Indians, all of whom received me most kindly, and listened attentively. These are a part of the great family who reach to the Youcan and beyond; but from their longer association with the whites, many of the darker traits that belong to their brethren on the Youcan, pertain, if at all, in a much milder form, to them and to the Indians at Lapienes House.

"I left my canoe and Indians, as well as those who had accompanied me, at the Fort; and taking two others who knew the way, I pursued the journey on foot over the Rocky Mountains to Lapienes House. This part of the journey fatigued me exceedingly, not so much from the distance (which was only from 75 to 100 miles,) as from the badness of the walking, intense heat of the sun, and myriads of the most voracious mosquitos that I have encountered in the country. There were several rivers to ford, which from the melting snows and recent rains, were just at their height. Fortunately they were neither very deep nor wide, or my stature and strength would have been serious impediments to my getting over them.

"At Lapienes House I met Mr. Jones, who was my companion from Red River to Fort Simpson. He had come up in charge of the Youcon boat, and kindly granted me a passage. I had fortunately a bundle of Canadian newspapers in my carpet bag, some of them containing speeches on educational subjects by his venerable grandfather the Bishop of Toronto. Five days of drifting and rowing down the rapid current of the Porcupine River brought us to its confluence with the Youcan, on the banks of which, about three miles above the junction, the Fort is placed. I met with a cordial reception from Mr. Lockhart, who was in charge, as well as from the energetic naturalist, Mr. R. Kennicott, who came into the district with me, and passed the greater part of his first winter at Fort Simpson. He delighted me with the assurance that he had met with a rich field for his labours as a naturalist, and that his efforts had been crowned with much success, especially in the collection of eggs; many rare and some hitherto unknown specimens, both of birds and their eggs, having been obtained by him, so that the cause of science in that department will be greatly benefitted by his labours. Among many others secured by him, I noticed the eggs and parent birds of the American Widgeon, the Black duck, Canvass-back duck, Spirit duck (*Bucephala albeola*); small Black-head duck (*Fulix affinis*); the Wax-wing, (*Ampelis garrulus*); the Kentucky warbler, the Trumpeter swan, the Duck hawk (*Falco anatum*), and two species of juncoes. The majority of those, however, have already been obtained in other parts of the district by the persevering zeal of Mr. Ross, the gentleman in charge at Lapiene's; and the wax-wing, which I noted as an exception, I have since learned builds its nests numerously in the vicinity of Bear Lake.

"On my arrival at the Youcan there were about five hundred Indians present, all of whom were astonished, but agreeably surprised, to see a missionary among them. They are naturally a fierce, turbulent, and cruel race; approximating more nearly to the Plain tribes than to the quiet Chippewyans of the McKenzie valley. They commence somewhere about the sixty-fifth degree of north latitude, and stretch westward from the McKenzie to Behring Straits. They were formerly very numerous, but wars both among themselves and with the Esquimaux have sadly diminished them. They are however still a strong and powerful people. They are divided into many petty tribes, each having its own chief, as the Tä-tlit-Kutchin (Peel's River Indians); Tä-küth-Kutchin (Lapiene's House Indians); Kutch-a-Kutchin (Youcan Indians); Touchon-tay-Kutchin (Wooded country Indians), and many others. But the general appearance, dress, customs, and habits of all are pretty much the same, and all go under the general names of Kutchin (the people) and Loucheux (squinters). The former is their own appellation, while the latter was given to them by the whites. There is, however, another division among them, of a more interesting and important character than that of the tribes just mentioned. Irrespective of tribe, they are divided into three classes, termed respectively Chit-sa, Nate-sa, and Tanges-at-sa—faintly representing the aristocracy, the middle classes, and the poorer orders of civilized nations: the former being the most wealthy, and the latter the poorest. In one respect, however, they greatly differ, it being the rule for a man not to marry in his own, but to take a wife from either of the other classes. A Chit-sa gentleman will marry a Tanges-at-sa peasant without the least feeling of degradation. The offspring in every case belongs to the class of the mother. This arrangement has had a most beneficial effect in allaying the deadly feuds formerly frequent among them. I witnessed a contest this summer, but it was far from being of a disastrous nature. The weapons used were neither the native bow nor imported gun, but the unruly tongue, and even it was used in the least objectionable way. A chief, whose tribe was in disgrace for a murder committed the summer before, met the chief of the tribe to which the victim belonged, and in the presence of all commenced a brilliant oration in favour of the latter and his people, while he feelingly deplored his own and his people's inferiority. At once, in the most gallant way, the offended chief, in a speech equally warm, refused the compliments so freely offered, and returned them all with interest upon his antagonist. This lasted for an hour or two when the offender, by a skilful piece of tactics, confessed himself so thoroughly beaten that he should never be able to open his lips again in the presence of his generous conqueror. Harmony was the inevitable result.

"The dress of all is pretty much the same. It consists of a tunic or shirt reaching to the knees, and very much ornamented with beads and ioqua shells from the Columbia. The trousers and shoes are attached, and ornamented with beads and shells similar to the tunics. The dress of the women is the same as that of the men, with the exception of the tunic being round instead of pointed in front.

"The beads above mentioned constitute the Indian's wealth. They are strung up in lengths in yards and fathoms, and form a regular currency among them. A fathom being the standard, and equivalent to the "made beaver" of the Company. Some tribes, especially the Kutch-a-Kutchin, are essentially traders, and instead of hunting themselves they purchase their furs from distant tribes, among whom they regularly make excursions. Often the medicine-men and chiefs have more beads than they can carry abroad with them, and when this happens the Company's stores are converted into banking establishments, where the deposits are invested for safe keeping. The women are fewer in number, and live a much shorter time than the men. This mortality among the women arises from their early marriage, the harsh treatment they receive, and the laborious work which they have daily to perform. While the marked inferiority in point of numbers is caused, I fear, by acts of infanticide, which are prevalent among them on the birth of female children. Praiseworthy efforts have been made by the Company's officers to prevent this, but the unhappy mothers have replied that they did it to prevent the child from experiencing the hardships they endure.

"The men reminded me of those of the Plain tribes, with their birds and feathers, nose jewels of ioqua shells, necklaces of copper, and plentiful supply of paint, which was almost the first time I had seen it used in the district. The nose jewels of the ioqua shells gave the expression of the face a singular appearance. The women did not use much paint, but its absence was atoned for by tatooing, which appeared universal among them. This singular custom seems to be one of the most widely diffused practices of savage life; and was not unknown among the ancients, as it, or something like it, seems to be forbidden to the Jews: "Ye shall not print any marks upon you."—Lev. xix. 28.

"Polygamy, which is prevalent in almost all other barbarous nations, is also common among these Youcon Indians, notwithstanding the great desparity in numbers of the sexes; and is often the source of much domestic unhappiness among them. The New Zealander multiplies his wives for show; but the object of the Kutchin is to have a greater number of poor creatures whom he can use as beasts of burden for hauling his wood, carrying his meat, and performing the drudgery of his camp. The Kutchins marry young, but no courtship precedes, nor does any ceremony attend the union. All that is requisite is the sanction of the mother of the girl, and often it is a matter of negotiation between her and the suitor when the girl is in her childhood; this, indeed, constitutes almost the sole prerogative of the sex. Neither the father nor any other of the girl's relatives apparently is allowed to have a voice in the matter.

"The tribes frequenting Peel's River dispose of their dead on stages, the corpse being securely enclosed in a rude coffin made out of a hollowed tree. About the Youcon, the older practice was to have the ashes collected, placed in a bag, and suspended from the top of a painted pole. Nightly wailings follow for a time, when the nearest relative makes a feast, invites his friends, and for a week or so the dead dance is performed, and a funeral dirge sung, after which all grief for the deceased is ended. I witnessed one of these dances while at the Fort; and have been told by others that the dead song is full of wild and plaintive strains, far superior to the music of any other tribes in the country. Altars or rites of religion they had none; and before the traders went there, apparently they had no idea of a God to be worshipped. They have their medicine men, in whose powers they place implicit faith, and whose aid they purchase in seasons of sickness or distress."

Mr. Kirkby describes his labours among these degraded savages as having been attended with many ameliorating results. Mothers, he says, confessed to him their deeds of infanticide, in terms sickening to listen to; evidencing as they did the misery of the wretched mother, driven to the revolting crime from a perverted tenderness for the child; and at the same time he bears testimony to the beneficent influence exercised by the officers of the Hudson's Bay Company in the Mackenzie River and Youcon valleys, in lessening the savage characteristics of the wild tribes by whom these are peopled. He describes the Flora of the region as exceedingly rich and varied; though expressing regret that he does not himself command a sufficient knowledge of Botany to describe it in detail. The Chive, a species of Onion, he speaks of as growing abundantly on the banks of the Porcupine River; and he promises to furnish in future communications a minute account of the geological features and the fauna of the district; as well as some of the legends of the Indian tribes occupying that remote and inhospitable region.

Such is a specimen of some of the first gleanings of science in "Rupert's Land," giving a foretaste of the valuable contributions which may be looked for from a band of intelligent labourers, combined to reap the rich harvest of varied knowledge in that virgin field. The incidental notice of the Esquimaux met with by Mr. Kirkby between Point Separation and Peel's River, though slight, is important, in its confirmation of recent notices by Arctic voyagers. The

Esquimaux, though claiming no share among the historical races of the world, and exercising no influence on the political relations of the Eastern and Western hemispheres, nevertheless occupy a remarkable position as the only people common alike to Asia and America. As the hyperborean type of the human race, they have usually been described as dwarfish and stunted. Dr. Latham especially refers to the physical difference between the Esquimaux and American Indians as constituting, along with the difficulties of their language, a valid basis of reasoning upon the difficult question as to how America was peopled. In defining those physical differences, he remarks: "Stunted as he is in stature, the Esquimaux is essentially a Mongol in physiognomy. His nose is flattened, his cheek-bones project, his eyes are often oblique, and his skin is more yellow and brown than red or copper-coloured." But Mr. Kirkby describes the Esquimaux whom he came in contact with as tall, active, remarkably strong, with heavy beards and a profusion of whiskers; while their complexions were so fair that his Indian guides compared them to Europeans. The features, especially of the women, are also referred to as regular and well-formed; while the privations to which they are exposed appear to have quickened their natural intelligence, so as to place them in that respect greatly in advance of the Red Indians bordering on the Arctic Circle. With opportunities so favourable for carrying on minute observations on the tribes of the North Western regions, noting their languages, and witnessing their native arts and customs, we may anticipate many valuable contributions to this department of science, when such labours are systematised, and guided in the most important directions of inquiry, by the combined exertions of those who are now happily organising a Scientific Institute for the North West.

## REVIEWS.

*Sketches of the Natural History of Ceylon;* with Narratives and Anecdotes illustrative of the Habits and Instincts of the Mammalia, Birds, Reptiles, Fishes, Insects, &c.; including a Monograph on the Elephant, and a description of the modes of capturing and taming it. With engravings from original drawings.

By Sir Jas. Emerson Tennent, K.C.S., LL.D., &c., author of "Ceylon: an Account of the Island—Physical, Historical, and Topographical," &c. London: Longman, Green, Longman, and Roberts. 1862.

Sir Jas. E. Tennent has here, as he informs us in his preface, given us a separate and much enlarged edition of the portion of his work on Ceylon which relates to Zoology. The additions chiefly belong to the narratives and anecdotes to which he could not well devote the necessary space in his larger work. The book in its present form is not only highly creditable to the knowledge and zeal of its author, and a very useful contribution to the department of geographical zoology, but a most entertaining and instructive companion to the lover of Nature, and admirably calculated to encourage a taste for natural history studies in the young of both sexes. It is a choice volume for the family and school library, and other collections which are expected to unite entertainment with instruction. We have taken it up now with the intention of making a few interesting extracts which will justify our recommendations, and make our readers desirous of seeing the work itself. We begin with a passage relating to one of the bats, which, from its numbers and curious habits, occupies a conspicuous place in the Ceylon fauna:

"But of all the bats, the most conspicuous from its size and numbers, and the most interesting from its habits, is the rousette of Ceylon; the 'flying fox,' as it is called by Europeans, from the similarity to that animal in its head and ears, its bright eyes, and intelligent little face. In its aspect it has nothing of the disagreeable and repulsive look so common amongst the ordinary vespertilionidæ; it likewise differs from them in the want of the nose-leaf, as well as of the tail. In the absence of the latter, its flight is directed by means of a membrane attached to the inner side of each of the hind legs, and kept distended at the lower extremity by a projecting bone, just as a fore-and-aft sail is distended by a 'gaff.'

"In size the body measures from ten to twelve inches in length, but the arms are prolonged, and especially the metacarpal bones and phalanges of the four fingers over which the leathery wings are distended, till the alar expanse measures between four and five feet. Whilst the function of these metamorphosed limbs in sustaining flight entitles them to the designation of 'wings,' they are endowed with another faculty, the existence of which essentially distinguishes them from the feathery wings of a bird, and vindicates the appropriateness of the term *Cheiro-ptera*, or 'winged hands,' by which the bats are designated. Over the entire surface of the thin membrane of which they are formed, sentient nerves of the utmost delicacy are distributed, by means of which the animal is enabled during the darkness to direct its motions with security, avoiding objects against contact with which at such times its eyes and other senses would be insufficient to protect it. Spallanzani ascertained the perfection of this faculty by a series of cruel experiments, by which he demonstrated that bats, even after their eyes had been destroyed, and their external organs of smell and hearing obliterated, were still enabled to direct their flight with unhesitating confidence, avoiding even threads suspended to intercept them. But after ascertaining the fact, Spallanzani was slow to arrive at its origin; and ascribed the surprising power to the existence of some sixth supplementary sense, the enjoyment of which was withheld from other animals, Cuvier, however, dissipated the obscurity by showing the seat of this extraordinary endowment to be in the wings, the superficies of which retains the exquisite sensitiveness to touch that is inherent in the palms of the human hand and the extremeties of the fingers, as well as in the feet of some of the mammalia. The face and head of the *Pteropus* are covered with brownish-grey hairs, the neck and chest are dark ferruginous grey, and the rest of the body brown, inclining to black.

"These active and energetic creatures, though chiefly frugivorous, are to some extent insectivorous also, as attested by their teeth, as well as by their habits. They feed, amongst other things, on the guava, the plantain, the rose-apple, and the fruit of the various fig-trees. Flying foxes are abundant in all the maritime districts, especially at the season when the *pulum-imbul*, one of the silk-cotton trees, is putting forth its flower-buds, of which they are singularly fond. By day they suspend themselves from the highest branches, hanging by the claws of the hind legs, with the head turned upwards, and pressing the chin against the breast. At sunset taking wing, they hover, with a murmuring sound occasioned by the beating of their broad membranous wings, around the fruit trees on which they feed till morning, when they resume their pensile attitude as before.

"A favourite resort of these bats is to the lofty india-rubber trees, which on one side overhang the Botanic Gardens of Paradenia, in the vicinity of Kandy. Thither, for some years past, they have congregated, chiefly in the autumn, taking their departure when the figs of the *ficus elastica* are consumed. Here they hang in such prodigious numbers, that frequently large branches give way beneath their accumulated weight. Every forenoon, generally between the hours of 9 and 11 A. M., they take to wing, apparently for exercise, and possibly to sun their wings and fur, and dry them after the dews of the early morning. On these occasions their numbers are quite surprising, flying in clouds as thick as bees or midges. After these recreations they hurry back to their favourite trees, chattering and screaming like monkeys, and always wrangling and contending angrily for the most shady and comfortable places in which to hang for the rest of the day protected from the sun. The branches they resort to soon become almost divested of leaves, these being stripped off by the action of the bats, attaching and detaching themselves by means of their hooked feet. At sunset, they fly off to their feeding-grounds, probably at a considerable distance, as it requires a large area to furnish sufficient food for such multitudes.

"In all its movements and attitudes, the action of the *Pteropus* is highly interesting. If placed upon the ground, it is almost helpless, none of its limbs being calculated for progressive motion; it drags itself along by means of the hook attached to each of its extended thumbs, pushing at the same time with those of its hind feet. Its natural position is exclusively pensile; it moves laterally from branch to branch with great ease, by using each foot alternately, and climbs, when necessary, by means of its claws.

"When at rest, or asleep, the disposition of the limbs is most curious. At such times it suspends itself by one foot only, bringing the other close to its side, and thus it is enabled to wrap itself in the ample folds of its wings, which envelop it like a mantle, leaving only its upturned head uncovered. Its fur is thus protected from damp and [rain, and to some extent its body is sheltered from the sun."

Our next extract relates to the leopard, illustrating, by an anecdote communicated by Major Skinner, the dread with which this animal is said to regard man:

"The following morning, anxious to gain a height for my observations in time to avail myself of the clear atmosphere of sunrise, I started off by myself through the jungle; leaving orders for my men, with my surveying instruments, to follow my track by the notches which I cut in the bark of the trees. On leaving the plain, I availed myself of a fine wide game track which lay in my direction, and [had gone, perhaps, half a mile from the camp, when I was startled by a slight rustling in the nilloo to my right, and in another instant, by the spring of a magnificent leopard, which, in a bound of full eight feet in height over the lower brushwood, lighted at my feet within eighteen inches of the spot whereon I stood, and lay in a crouching position, his fiery gleaming eyes fixed on me.

"The predicament was not a pleasant one. I had no weapon of defence, and with one spring or blow of his paw the beast could have annihilated me. To move I knew would only encourage his attack. It occurred to me at the moment that I had heard of the power of man's eye over wild animals, and accordingly I fixed my gaze as intently as the agitation of such a moment enabled me, on his eyes: we stared at each other for some seconds, when, to my inexpressible joy, the beast turned and bounded down the straight open path before me. This scene occurred just at that period of the morning when the grazing animals retired from the open patena to the cool shade of the forest: doubtless, the leopard had taken my approach for that of a deer, or some such animal. And if his spring had been at a quadruped instead of a biped, his distance was so well measured, that it must have landed him on the neck of a deer, an elk, or a buffalo; as it was, one pace more would have done for me. A bear would not have let his victim off so easily."

The highly interesting account of the elephant, and the method employed in Ceylon for his capture, is too long for our purpose; but the following passage, describing the approach to the scene of a great corral witnessed by the author, gives some idea of the glorious richness of Nature in that beautiful island:

"Kornegalle, or Kurunai-galle, was one of the ancient capitals of the island, and the residence of its kings from A.D. 1319 to 1347. The dwelling-house of the principal civil officer in charge of the district now occupies the site of the former palace, and the ground is strewn with fragments of columns and carved stones, the remnants of the royal buildings. The modern town consists of the bungalows of the European officials, each surrounded with its own garden; two or three streets inhabited by Dutch descendants and by Moors; and a native bazaar, with the ordinary array of rice and curry stuff, and cooking chattees of brass or burnt clay.

"The charm of the village is the unusual beauty of its position. It rests within the shade of an enormous rock of gneiss upwards of 600 feet in height, nearly denuded of verdure, and so rounded and worn by time that it has acquired the form of a couchant elephant, from which it derives its name of Aetagalla, the Rock of the Tusker. But Aetagalla is only the last eminence in a range of similarly-formed rocky mountains, which here terminate abruptly; and which, from the fantastic shapes into which their gigantic outlines have been wrought by the action of the atmosphere, are called by the names of the Tortoise Rock, the Eel Rock, and the Rock of the Tusked Elephant. So impressed are the Singhalese by the aspect of these stupendous masses, that in ancient grants lands are conveyed in perpetuity, or 'so long as the sun and the moon, so long as Aetagalla and Andagalla shall endure.'

"Kornegalle is the resort of Buddhists from the remotest parts of the island, who come to visit an ancient temple on the summit of the great rock, to which access is had from the valley below by means of steep paths and steps hewn out of the solid stone. Here the chief object of veneration is a copy of the sacred footstep hollowed in the granite, similar to that which confers sanctity on Adam's Peak, the towering apex of which, about forty miles distant, the pilgrims can discern from Aetagalla.

"At times the heat at Kornegalle is intense, in consequence of the perpetual glow diffused from these granite cliffs. The warmth they acquire during the blaze of noon becomes almost intolerable towards evening, and the sultry night is too short to permit them to cool between the setting and the rising of the sun. The district is also liable to occasional droughts, when the watercourses fail and the tanks are dried up. One of these calamities occurred about the period of my visit, and such were the sufferings of the wild animals that numbers of crocodiles and bears made their way into the town to drink at the wells. The soil is prolific in the extreme; rice, cotton, and dry grain are cultivated largely in the valley. Every cottage is surrounded by gardens of cocoa-nuts, arecas, jak-fruit, and coffee; the slopes, under tillage, are covered with luxuriant vegetation, and as far as the eye can reach on every side, there are dense forests intersected by streams, in the shade of which the deer and the elephant abound.

"In 1847, arrangements were made for one of the great elephant hunts for the supply of the Civil Engineer's Department, and the spot fixed on by Mr. Morris, the government officer who conducted the corral, was on the banks of the Kimbul river, about fifteen miles from Kornegalle. The country over which we rode to the scene of the approaching capture showed traces of the recent drought, the fields lay to a great extent untilled, owing to the want of water, and the tanks, almost reduced to dryness, were covered with the leaves of the rose-coloured lotus.

"Our cavalcade was as oriental as the scenery through which it moved; the Governor and the officers of his staff and household formed a long cortegé, escorted by the native attendants, horse-keepers, and foot-runners. The ladies were borne in palankins, and the younger individuals of the party carried in chairs raised on poles, and covered with cool green awnings made of the fresh leaves of the talipat palm.

"After traversing the cultivated lands, the path led across open glades of park-like verdure and beauty, and at last entered the great forest, under the shade of ancient trees wreathed to their crowns with climbing plants, and festooned by natural garlands of convolvulus and orchids. Here silence reigned, disturbed only by the murmuring hum of glittering insects, or the shrill clamour of the plum-headed parroquet and the flute-like calls of the golden oriole.

"We crossed the broad sandy beds of two rivers over-arched by tall trees, the most conspicuous of which is the Kombook, from the calcined bark of which the natives extract a species of lime to be used with their betel. And from the branches hung suspended over the water the gigantic pods of the huge puswael bean, the sheath of which measures six feet long by five or six inches broad.

"On ascending the steep bank of the second stream, we found ourselves in front of the residences which had been extemporised for our party in the intermediate vicinity of the corral. These cool and enjoyable structures were formed of branches and thatched with palm leaves and fragrant lemon grass; and in addition to a dining-room and suites of bedrooms fitted with tent furniture, they included kitchens, stables, and store-rooms, all run up by the natives in the course of a few days."

We now pass to the birds, and are irresistably attracted by the account of *Corvus splendens,* the common Ceylon crow, which reminds us of the tricks of the European magpie, but exceeds that bird greatly in sagacity and in familiarity with man:—

"*Crows.*—Of all the Ceylon birds of this order the most familiar and notorious are the small glossy crows, whose shining black plumage shot with blue has suggested the title of *Corvus splendens.* They frequent the towns in companies, and domesticate themselves in the close vicinity of every house; and it may possibly serve to account for the familiarity and audacity which they exhibit in their intercourse with men, that the Dutch during their sovereignty in Ceylon, enforced severe penalties against any one killing a crow, under the belief that they were instrumental in extending the growth of cinnamon by feeding on the fruit, and thus disseminating the undigested seed.

"So accustomed are the natives to their presence and exploits, that, like the Greeks and Romans, they have made the movements of crows the basis of their auguries; and there is no end to the vicissitudes of good and evil fortune which may not be predicted from the direction of their flight, the hoarse or mellow notes of their croaking, the variety of trees on which they rest, and the numbers in which they are seen to assemble.

"All day long these birds are engaged in watching either the offal of the offices, or the preparation for meals in the dining-room: and as doors and windows are necessarily opened to relieve the heat, nothing is more common than the passage of a crow across the room, lifting on the wing some ill-guarded morsel from the dinner-table. No article, however unpromising its quality, provided only it be portable, can with safety be left unguarded in any apartment accessible to them. The contents of ladies' work-boxes, kid gloves, and pocket handkerchiefs vanish instantly if exposed near a window or open door. They open paper parcels to ascertain the contents; they will undo the knot on a napkin if it encloses anything eatable, and I have known a crow to extract the peg which fastened the lid of a basket in order to plunder the provender within.

"On one occasion a nurse seated in a garden adjoining a regimental mess-room, was terrified by seeing a bloody clasp-knife drop from the air at her feet; but the mystery was explained on learning that a crow, which had been watching the cook chopping mince-meat, had seized the moment when his head was turned to carry off the knife.

"One of these ingenious marauders, after vainly attitudinising in front of a chained watch-dog, that was lazily gnawing a bone, and after fruitlessly endeavouring to divert his attention by dancing before him, with head awry and eye askance, at length flew away for a moment, and returned bringing a companion which perched itself on a branch a few yards in the rear. The crow's grimaces were now actively renewed, but with no better success, till its confederate, poising itself on its wings, descended with the utmost velocity, striking the dog upon the spine with all the force of its strong beak. The *ruse* was successful; the dog started with surprise and pain, but not quickly enough to seize his assailant, whilst the bone he had been gnawing was snatched away by the first crow the instant his head was turned. Two well-authenticated instances of the recurrence of this device came within my knowledge at Colombo, and attest the sagacity and powers of communication and combination possessed by these astute and courageous birds.

"On the approach of evening the crows near Colombo assemble in noisy groups along the margin of the fresh-water lake which surrounds the fort on the eastern side; and here for an hour or two they enjoy the luxuries of throwing the water over their shining backs, and arranging their plumage decorously, after which they disperse, each taking the direction of his accustomed quarters for the night."

We must add a sketch of a breeding place of water-fowl on a solitary spot amidst the remains of a vast ruined tank, the work of the early kings of Ceylon:—

"In a lonely spot, towards the very centre of the tank, we came unexpectedly upon an extraordinary scene. A sheet of still water, two or three hundred yards broad, and about half a mile long, was surrounded by a line of tall forest-trees, whose branches stretched above its margin. The sun had not yet risen, when we perceived some white objects in large numbers on the tops of the trees; and as we came nearer, we discovered that a vast colony of pelicans had formed their settlement and breeding-place in this solitary retreat. They literally covered the trees in hundreds; and their heavy nests, like those of the swan, constructed of large sticks, forming great platforms, were sustained by the horizontal branches. Each nest contained three eggs, rather larger than those of a goose; and the male bird stood placidly beside the female as she sat upon them.

"Nor was this all; along with the pelicans prodigious numbers of other water-birds had selected this for their dwelling-place, and covered the trees in thousands, standing on the topmost branches; tall flamingoes, herons, egrets, storks, ibises, and other waders. We had disturbed them thus early, before their habitual hour for betaking themselves to their fishing-fields. By degrees, as the light increased, we saw them beginning to move upon the trees; they looked around them on every side, stretched their awkward legs behind them, extended their broad wings, gradually rose in groups, and slowly soared away in the direction of the sea-shore."

We must give our readers a specimen of what is said of Ceylon reptiles; but in the abundance of curious and entertaining matter, we are at a loss how to choose.—What follows relates to the night lizards or geckoes:—

"The most familiar and attractive of the lizard class are the *Geckoes*, that frequent the sitting-rooms, and being furnished with pads to each toe, they are enabled to ascend perpendicular walls and adhere to glass and ceilings. Being nocturnal in their habits, the pupil of the eye, instead of being circular as in the diurnal species, is linear and vertical like that of the cat. As soon as evening arrives, the geckoes are to be seen in every house in keen and crafty pursuit of their prey; emerging from the chinks and recesses where they conceal themselves during the day, to search for insects that then retire to settle for the night. In a boudoir where the ladies of my family spent their evenings, one of these familiar and amusing little creatures had its hiding-place behind a gilt picture frame. Punctually as the candles were lighted, it made its appearance on the wall to be fed with its accustomed crumbs; and if neglected, it reiterated a sharp, quick call of *chic*, *chic*, *chic*, till attended to. It was of a delicate grey colour, tinged with pink; and having by accident fallen on a work-table, it fled, leaving part of its tail behind it, which, however, it re-produced within less than a month. This faculty of reproduction is doubtless designed to enable the creature to escape from its assailants: the detaching of the limb is evidently its own act; and it is observable, that when reproduced, the tail generally exhibits some variation from the previous form, the diverging spines being absent, the new portion covered with small square uniform scales placed in a cross series, and the scuta below being seldom so distinct as in the original member. In an officer's quarters in the fort of Colombo, a geckoe had been taught to come daily to the dinner-table, and always made its appearance along with the dessert. The family were absent for some months, during which the house underwent extensive repairs, the roof having been raised, the walls stuccoed, and the ceilings whitened. It was naturally surmised that so long a suspension of its accustomed habits would have led to the disappearance of the little lizard; but on the return of its old friends, it made its entrance as usual at their first dinner the instant the cloth was removed."

We add a passage respecting the Hydrophidae or sea-snakes, an extraordinary race of reptiles, belonging only to the Indian and Pacific Oceans:—

"The *sea-snakes* of the Indian tropics did not escape the notice of the early Greek mariners who navigated those seas; and amongst the facts collected by them, Ælian has briefly recorded that the Indian Ocean produces serpents *with flattened tails*, whose bite, he adds, is to be dreaded less for its venom than the laceration of its teeth. The first statement is accurate, but the latter is incorrect, as there is in an all but unanimous concurrence of opinion that every species of this family of serpents is more or less poisonous. The compression of the tail noticed by Ælian is one of the principal characteristics of these reptiles, as their motion through the water is mainly effected by its aid, coupled with the undulating movement of the rest of the body. Their scales, instead of being imbricated like those of land-snakes, form hexagons; and those on the belly, instead of being scutate and enlarged, are nearly of the same size and form as on other parts of the body.

"Sea-snakes (*Hydrophis*) are found on all the coasts of Ceylon. I have sailed through large shoals of them in the Gulf of Manaar, close to the pearl-banks of Aripo. The fishermen of Calpentyn on the west live in perpetual dread of them, and believe their bite to be fatal. In the course of an attempt which was recently made to place a lighthouse on the great rocks of the south-east coast, known by seamen as the Basses, or *Baxos*, the workmen who first landed found the portion of the surface liable to be covered by the tides, honey-combed, and hollowed into deep holes filled with water, in which were abundance of fishes and some molluscs. Some of these cavities also contained sea-snakes from four to five feet long, which were described as having the head 'hooded like the cobra de capello, and of a light grey colour, slightly speckled. They coiled themselves like serpents on land, and darted at poles thrust in among them. The Singhalese who accompanied the party, said that they not only bit venomously, but crushed the limb of any intruder in their coils.'

"Still, sea-snakes, though well-known to the natives, are not abundant round Ceylon, as compared with their numbers in other places. Their principal habitat is the ocean between the southern shores of China and the northern coast of New Holland; and their western limit appears to be about the longitude of Cape Comorin. It has long since been ascertained that they frequent the seas that separate the islands of the Pacific; but they have never yet been found in the Atlantic, nor even on the western shores of tropical America. And if, as has been stated, they have been seen on a late occasion in considerable numbers in the Bay of Panama, the fact can only be regarded as one of the rare instances, in which a change in the primary distribution of a race of animals has occurred, either by an active or a passive immigration. Being exclusively inhabitants of the sea, they are liable to be swept along by the influence of currents; but to compensate for this they have been endowed with a wonderful power of swimming. The individuals of all the groups of terrestrial serpents are observed to be possessed of this faculty to a greater or a less degree; and they can swim for a certain distance without having any organs specially modified for the purpose; except, perhaps, the lung, which is a long sac capable of taking in a sufficient quantity of air, to keep the body of the snake above water. Nor do we find any peculiar or specially adapted organs even in the fresh-water-snakes, although they can catch frogs or fishes while swimming. But in the *hydrophids*, which are permanent inhabitants of the ocean, and which in an adult state, approach the beach only occasionally, and for very short times, the tail, which is rounded and tapering in the others, is compressed into a vertical rudder-like organ, similar to, and answering all the purposes of, the caudal fin in a fish. When these snakes are brought on shore or on the deck of a ship, they are helpless, and struggle vainly in awkward attitudes. Their food consists exclusively of such fishes as are found near the surface; a fact which affords ample proof that they do not descend to great depths, although they can dive as well as swim. They are often found in groups during calm weather, sleeping on the sea; but owing to their extreme caution and shyness, attempts to catch them are rarely successful; on the least alarm, they suddenly expel the air from their lungs and descend below the surface; a long stream of rising air-bubbles marking the rapid course which they make below. Their poisonous nature has been questioned; but the presence of a strong perforated tooth and of a venomous gland sufficiently attest their dangerous powers, even if these had not been demonstrated by the effects of their bite. But fortunately for the fishermen, who sometimes find them unexpectedly among the contents of their nets, sea-snakes are unable, like other venomous serpents, to open the jaws widely, and in reality they rarely inflict a wound. Dr. Cantor believes, that they are blinded by the light when romoved from their own element; and he adds that they become sluggish and speedily die."

We will positively resist the temptation to extract anything relating to fishes, mollusca, insects, &c., that we may in conclusion give our author's account of the land leeches which to many readers will be as novel and wonderful as anything he relates:—

"Of all the plagues which beset the traveller in the rising grounds of Ceylon, the most detested are the land leeches. They are not frequent in the plains, which are too hot and dry for them; but amongst the rank vegetation in the lower ranges of the hill country, which is kept damp by frequent showers, they are found in tormenting profusion. They are terrestrial, never visiting ponds or streams. In size they are about an inch in length, and as fine as a common knitting needle; but they are capable of distension till they equal a quill in thickness, and attain a length of nearly two inches. Their structure is so flexible that they can insinuate themselves through the meshes of the finest stocking, not only seizing on the feet and ankles, but ascending to the back and throat and fastening on the tenderest parts of the body. In order to exclude them, the coffee planters, who live amongst these pests, are obliged to envelope their legs in 'leech-gaiters' made of closely woven cloth. The natives smear their bodies with oil, tobacco ashes, or lemon juice; the latter serving not only to stop the flow of blood, but to expedite the healing of the wounds. In moving, the land leeches have the power of planting one extremity on the earth and raising the other perpendicularly to watch for their victim. Such is their vigilance and instinct, that on the approach of a passer-by to a spot which they infest, they may be seen amongst the grass and fallen leaves on the edge of a native path, poised erect, and preparing for their attack on man and horse. On descrying their prey they advance rapidly by semi-circular strides, fixing one end firmly and arching the other forwards, till by successive advances they can lay hold of the traveller's foot, when they disengage themselves from the ground and ascend his dress in search of an aperture to enter. In these encounters the individuals in the rear of a party of travellers in the jungle invariably fare worst, as the leeches, once warned of their approach, congregate with singular celerity. Their size is so insignificant, and the wound they make is so skilfully punctured, that both are generally imperceptible, and the first intimation of their onslaught is the trickling of the blood or a chill feeling of the leech when it begins to hang heavily on the skin from being distended by its repast. Horses are driven wild by them, and stamp the ground in fury to shake them from their fetlocks, to which they hang in bloody tassels. The bare legs of the palankin bearers and coolies are a favourite resort; and, as their hands are too much engaged to be spared to pull them off, the leeches hang like bunches of grapes round their ankles; and I have seen the blood literally flowing over the edge of a European's shoe from their innumerable bites. In healthy constitutions the wounds, if not irritated, generally heal, occasioning no other inconveience than a slight inflamation and itching; but in those with a bad state of body, the punctures, if rubbed, are liable to degenerate into ulcers, which may lead to the loss of limb or even of life. Both Marshall and Davy mention, that during the march of troops in the mountains, when the Kandyans were in rebellion, in 1818, the soldiers, and especially the Madras sepoys, with the pioneers and coolies, suffered so severely from this cause that numbers perished.

"One circumstance regarding these land leeches is remarkable and unexplained; they are helpless without moisture, and in the hills where they abound at all other times, they entirely disappear during long droughts;—yet re-appear instantaneously on the very first fall of rain; and in spots previously parched, where not one was visible an hour before, a single shower is sufficient to reproduce them in thousands, lurking beneath the decaying leaves, or striding with rapid movements across the gravel. Whence do they re-appear? Do they, too, take a 'summer sleep,' like the reptiles, molluscs, and tank fishes? or may they, like the *Rotifera*, be dried up and preserved for an indefinate period, resuming their vital activity on the mere recurrence of moisture?"

W. H.

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*The uses of Animals in relation to the Industry of Man:* being a course of lectures delivered at the South Kensington Museum by E. Lankester, M.D., F.R.S., Superintendent of the Animal Product and Food Collections. 1 vol. London: Robert Hardwicke.

*On Food:* being lectures delivered at the South Kensington Museum by E. Lankester, M.D., F.R.S., Superintendent of the Animal Product and Food Collections. 1 vol. London: Robert Hardwicke. 1861.

Dr. Lankester is a naturalist of high reputation, and he has been most usefully employed both in delivering the courses of lectures contained in these volumes so as to bring out the real value and importance of the collections which have been placed under his care, and make them contribute most effectually to public instruction, and also in extending the benefit of his labours far more widely by the publication of these pleasing volumes, characterized by sound knowledge, without any display of science, intelligible and attractive in their style, and eminently fitted for a wide popularity; a mere enumeration of the subjects of the twelve lectures making up the first of these volumes will give a good idea of its interest: silk, wool, leather, bone, soap, waste, sponges and corals, shell-fish, insects, furs, feathers, horns and hair, animal perfumes. Under each of these heads a great variety of entertaining and practically useful information has been collected.

No body can look through the volume without being impressed with the educational importance of natural history and chemistry, and the degree in which the diffusion of real knowledge must contribute to improve the practical arts of life, as well as to render their exercise a more intelligent act, and more interesting to those engaged in it, than it can possibly be as a mere mechanical routine. In this connection we quote the concluding passage of Dr. Lankester's volume:—

"It is only," he says, "by a systematic training in the principles of the natural sciences involved in their occupations that we can expect our working men or their masters to execute their work with all that skill and economy of which their industry is susceptible. By the present system of working by the rule of thumb, an enormous waste of energy and labour is daily taking place, which, if properly economised according to natural laws, would produce an exuberance of comfort, and even luxury, where now only squalor and suffering present themselves. The knowledge of natural laws is the first great condition of man's existence and advancement. It is in vain for him to cultivate the dead literature of the past if he is negligent of the overflowing life of the present. He lives in the presence of forces which, if he does not master them and make them his servants, will master him, and he will be their slave. Nor is it the culture of art that will save him from the terrible presence of the powers that every where threaten his existence. His palace, however beautiful, must be built in accordance with the laws of gravitation; the material of his most cherished forms of beauty must be constructed in accordance with chemical laws; his actions, however graceful, must be made in accordance with physiological laws, or the whole must perish. It is for us in these times to cherish, as the most precious gifts of Providence, those discoveries of genius in the domain of natural science which distinguish the civilization of our age. In those discoveries we have the key to unlock the great secrets by which our existence is bound up with the laws of the universe. It is just as we study these laws and apply them to the varied purposes of our life, that we shall be able to lead that existence which is the highest dignity of man, and realize those blessings which a knowledge of that which is true can alone confer."

We might make many extracts from this volume, but as it is a readable book which ought to be generally read, we abstain, desiring to send many to the work itself. We allow ourselves, however, to copy one passage, the merriment of which forcibly brings back to our minds pleasant hours passed with the author and the distinguished friend, prematurely, alas! called away from us, to whom he refers; and none knew better than these men how to unite merriment with wisdom and knowledge:—

"Another bivalve sometimes eaten by the inhabitants of our coast is the Razor-fish (*Solen maximus.*) This creature would be interesting enough to us if it were not eaten, on account of its long, slightly-curved and truncated shells, which resemble the blade of a razor. It is not uncommon on our sandy shores, where it lives buried in the sand. It is not difficult to find, as above the spot into which it has retired it leaves an impression of two holes united, something like a keyhole. It is, however, almost useless to attempt to dig them up, they back away from you so skillfully. After many vain efforts to secure one of these creatures alive, I mentioned my failures to the late Professor Edward Forbes. 'Oh,' he said, with a waggish smile, 'there is nothing easier: all you have to do is to put a little salt over their holes, and they will come out.' I remembered, you know, the story of putting salt on a bird's tail, and although I resolved secretly to try my friend's plan, it was so simple, I had not the courage to tell him that I would. I had, however, no sooner got to the seaside than I quietly stole to the pantry and pocketed some salt, and then went alone, at low tide, to the sandy shore. As soon as I espied a hole, I looked round, for I almost fancied I heard my friend chuckle over my shoulder; however, nobody was there, and down went a pinch of salt over the hole. What I now beheld almost staggered me. Was it the ghost of some razor-fish whose head I had chopped off in digging that now rose before me to arraign me for my malice? or was it a real live razor-fish that now raised its long shell at least half out of the sand? I grasped it, fully expecting it would vanish, but I found I had won my prize. It was a real solid specimen of the species *Solen maximus* that I had in my hand. I soon had a number of others, which were all carried home in triumph. Of course there were more than were required for science, and, at the suggestion of a Scotch friend, the animals not wanted were made into soup. When the soup was brought to table, our Scotch friend vowed it particularly fine, and ate a basin with at least twenty razor-fish in it. One tablespoonful satisfied the ladies, whilst myself and an English friend declared--against our conscience I do verily believe—that we had never eaten any thing more excellent. I counted the number of the creatures I was able to swallow; it amounted to exactly three! After a tumbler of whiskey and water—taken, of course, medicinally—arrangements were made for a dredge in the morning. The Scotchman was up at five, but I and my English friend could not make our appearance. Nightmare and other symptoms of indigestion had fairly upset us for anything so ticklish as a dredging excursion. Now, I do not wish to say anything against razor-fish as an article of diet, but from what I have told you, they would seem to possess an amount of resistance to the ordinary digestive activity of the stomach that would render it highly desirable to ensure, before taking them, such a digestion as a Highlander, fresh from his mountain wilds, is known to possess."—May we ask, by the way, how it is that our familiar friend *Solen siliqua* appears here under the specific name of *maximus*, a name which we do not even recollect as a synonyme? It is true we have not at hand good references on British conchology, but we cannot help suspecting that our author, writing from memory, used a wrong name. It would be useless for us to protest against the zoological system which our author, in common with, perhaps, the leading European zoologists at the present time, has adopted. It is enough for us to repeat, that we hold firmly to the divisions Articulata and Radiata instead of Annulata and Coelenterata; but we should have expected from Dr. Lankester, according to the system he has employed, that he would have better appreciated the value of the sub-kingdoms than to have spoken, as he has often done, of Vertebrata and Invertebrata in contrast. We had understood it to be agreed upon among philosophical zoologists, that invertebrate animals cannot now be regarded as in any sense a division, and that the distinctions between Mollusca, for example, and either of the other sub-kingdoms, are quite as important as those which separate them from Vertebrata.

Dr, Lankester's other volume occupies ground at least as interesting and important as that of which we have spoken; and he has treated his subject with the same knowledege, care and judgment which are manifested in it. His object is to give useful information by explaining the relations of food in its several kinds to the support of the system, and to the health and enjoyment of human beings. We fear he may have assumed a more general acquaintance with the elements of chemistry than his readers will possess; but he will, no doubt, succeed by the clearness of his explanations in making most readers sufficiently comprehend his meaning. He divides human food into three classes: 1. Alimentary or necessary food; 2. Medicinal or auxiliary food; 3. Accessory food. The latter kind, of which gum and gelatine are examples—not contributing anything to the support of the frame, but being merely a useful accompaniment to things that do. The first class contains three groups: 1. Mineral—as water, salt, and various substances found in the ashes of plants and animals; 2. Carbonaceous or heat-giving, to which belong starch, sugar, fat; 3. Nitrogenous or flesh-forming, consisting of albumen, fibrine, caseine. The second class has likewise three groups—the 4th consisting of stimulants, as alcohol and volatile oils; the 5th of neurotics

—such alkaloids as are found in tea and coffee, and cocoa; 6th. Narcotics, as tobacco and opium. The third class forms a seventh group, and these include all the varieties of human food. It is the object to shew from the constitution of our frame in what way each is required, and then practically by what articles of ordinary food each is supplied. The interest of the subject will be generally appreciated; we can but touch on a few points. Under the head of Nitrogeneous or flesh-forming materials, we meet with the following remarks in connection with the albumen contained in blood:—

> "This leads to a question on which I wish to say a few words; and that is, as to whether we are wise economically, and are justified in bleeding animals to death and throwing away all the blood, which is, after all, good food. When you recollect that we take from 5 lbs. to 20 lbs. from a sheep or an ox, and multiply that by the number of sheep and oxen killed in the course of a year, you will find that it amounts to something which is quite frightful to contemplate. Now, I have no hesitation in saying that the blood you take away is just as good as the blood you leave in, and that you would do much better to leave the blood in the animal. There are other ways of killing animals than bleeding them to death. These are unpleasant things to think of; but, after all, we have no hesitation in eating the mutton and beef after it is slain, and we ought to be able to give a reason for our extravagance. We do not take the blood away from hares and rabbits: they are brought to the table and eaten by the most fastidious. So also with birds: pheasants and partridges —we do not bleed them; and I tell you more—if you did, they would not be so pleasant to eat; they would lose some of their gamey flavour. Dr. Carson, of Liverpool, many years ago pointed out the loss incurred in the present mode of killing animals, and suggested a method of killing them by which blood was saved; and Dr. Carson induced a certain number of people of Liverpool to try meat killed in his way, and they declared it so much better, that a butcher was induced to kill his animals in that way, and the result has been that he has surrounded himself with customers. Mr. Carson, son of the late doctor, was kind enough to send me up a quarter of a sheep which had been killed in this way; I invited a few friends to partake of it, and they one and all pronounced it delicious. Economically, this is an important question, and it ought to be a consideration whether we are justified in throwing away so large a quantity of nutritious albumen."

This is immediately followed by remarks on the non-nutritious character of gelatine, which, being opposed to a very general prejudice, and yet conveying a well-established truth, we may extract as a specimen of the useful influence of the book:—

> "The quantities of fibrine and albumen in butcher's meat are about the same; but I have now to draw your attention to another constituent, which has

always figured in all our chemical analyses as flesh-forming matter. If we take a quantity of beef or mutton, or even of pork, and boil it for a certain length of time, we obtain from it a substance which thickens the water as it cools, and makes it into what we call a jelly. Now, that substance has been supposed to be the nutritive matter of the meat. It has been extracted and sold separately from the other constituents of the meat as nutritive matter; the impression is that this matter is more nutritive than other kinds of food, and it is given to persons who are weak and dying for want of strength to keep them up; and yet I have an extraordinary statement to make to persons who believe in this, that this is not nutritive matter at all; and, although not to be objected to when mixed with other substances, alone it certainly is not capable of supporting life. This substance is called gelatine. It exists in the nerves and muscles and all kinds of flesh of animals. It forms, in fact, the cell-walls of animals. The cell-walls of plants are composed of cellulose. Both cellulose and gelatine are insoluble in cold water, and the difference between them is, that gelatine is soluble in hot water. Gelatine is obtained from all kinds of animals, and all parts, and from bone, and skin, and membrane. This gelatine is used in the arts for making size and glue, and for fining beer and wine, and various other purposes.

"The sound of the sturgeon and of various other fish is composed almost entirely of this substance, and when prepared and cut into strips it is called isinglass. It is obtained commercially, for dietetical purposes, from a variety of things, from the skins of animals not sent to the curriers, and from bones, and so on; and very good gelatine is procured from the refuse of the tanner's yard. So that the substance which we know in the arts as glue and size, and as food under the name of gelatine or isinglass, is this gelatine which you can get from all parts of animals by boiling. Then, I say, it is not a nutritive substance; it is not a digestible substance, and, therefore, cannot be nutritive. Many years ago, the French, being fond of soups, and the poor living principally on soups, discovered that those persons who lived on soups suffered in their health. This became a question, of so much importance that a commission was appointed to inquire into the properties of gelatine, and the result was that it was reported that gelatine had no nutritive property. The impression on the public mind was, however, so favourable, that it was still used in France; and a second commission was appointed, and the result of its labours confirmed the conclusions of the first commission. In Belgium, also, a public inquiry was instituted, the result was the same conclusion as the two French commissions. You do not find this gelatine in the blood. If it were a nutritive agent, you would find it there. You do not find it in eggs, nor do you find it in milk. Seeing, then, there is no gelatine in these nutritive things, which are naturally prepared to form the parts of the body, we are warranted in concluding that it is not a flesh-forming substance at all. Then it appears that this substance is merely an accessory in our usual food, just what cellulose and gum are in our vegetable food. Hence I have called these substances accessory foods. They are not to be rejected; they do not injure; on the contrary, I believe there is evidence that they do good.

"It is found in feeding horses, that if you give them beans or oats alone they will not do so well as if you mix with these more nutritive foods a quantity of chaff, chopped straw, which is little more than cellulose. It appears to me that man has the same relation to these things, and that he requires some indigestible food. In all our food there is a certain quantity of indigestible matter, and if it does not disagree it acts beneficially. This is one recommendation of brown bread, it contains more cellulose than flour. Those who can eat brown bread habitually have better health than those who cannot, or who persist in eating white bread."

It may be well also to present to our readers the author's judgment with which we entirely agree on the question of the fitness of our using animal food. We cannot, indeed, copy the illustrative woodcuts to which he refers, but they are scarcely necessary to the argument, and any one who desires it may actually refer to the objects themselves, substituting for the tiger's skull an inspection of the mouth of a domestic cat.

"Let me add now a few words on the subject of living only on vegetable food. You know from what I have said that I am an advocate of a mixed diet for man, but I would more particularly draw your attention to a statement that is often made, that it is not necessary to partake of animal food at all. Persons who argue thus, put forth, as a first ground, the immorality of the act, and the impropriety and wickedness of taking away life at all. This is surely an absurd assumption; for the Creator has made a certain number of creatures that could not live upon vegetable food, and they naturally prey upon the lower animals which feed on the grass and the herbs of the field. The lion and tiger exist by prey; and it appears to me that man has a perfect right, without being charged with immorality or impropriety, to take the lives of the lower animals for his food.

Then anatomical arguments are adduced against animal food. It is said that man, in his structure, is better adapted for vegetable than animal food. I must here again join issue, for I believe I can shew you from his structure that man is more adapted for a mixed diet than either vegetable or animal alone. Here is a view of the jaws and teeth of a carnivorous creature. The jaws are so constructed that they will only move up and down like a pair of scissors. This is the head of a tiger. Look also at his sharp-pointed carnivorous teeth, especially the great canine teeth. They are intended for holding and cutting up living food. Now look at the horse. His lower jaw is quite movable from side to side. Instead of pointed teeth, they are flat, and every arrangement is made for grinding, not cutting the food; and this is the character of the mouth of a herbivorous animal.

Now if we take the skull of a man we find he has certain teeth—canine teeth—which, like those of lions and tigers, have the power of cutting; but he has also flat teeth, and the power of moving his lower jaw laterally, and can bring these flat teeth across each other for the purpose of grinding his food; so that you see he is evidently provided with instruments to enable him to prepare for his digestion both vegetable and animal food. I might prolong this argument by shewing you the complicated structure of the stomach of the sheep and the ox, and comparing this with the stomach of the lion, point to the fact that the human stomach has neither the complicated structure of the one nor the simplicity of the other. There are many other points of structure in which man seems to stand between these two groups of animals—the herbivorous on the one side and the carnivorous on the other—which would seem to indicate his adaptation for taking both kinds of food.

"But whatever may be the arguments of the vegetarians, they do not practically carry out their doctrines, for they partake of considerable quantities of animal food. They take milk and butter, and cheese and eggs. Dr. Carpenter states, in a recent review, that he had taken a vegetarian cookery-book, and calculated the quantity of milk, butter and eggs employed in their food, and found that, if a vegetarian family lived in accordance with the rules of this book, each member would consume half an ounce more animal food a day than he did in his own family,—and he was no vegetarian. So that you see people are deceiving themselves who enforce such a doctrine as this.

"On the other hand, there are some persons who advocate a diet of purely animal food. I had a book sent me the other day, written by a gentleman at Liverpool, who states that he has discovered that the panacea for all human evils is the taking of animal food alone; and he takes the opportunity of stating that he is looking for some young lady of similar principles and practice who will link her fortunes with his own, and establish a family of carnivorians.

"There is no question that man may live on a purely vegetable diet; but the question is as to whether that kind of diet is best for the community. We find in the history of man that those races who have partaken of animal food are the most vigorous, the most moral, and the most intellectual races of mankind. You find that the ancient Jews, although they had certain sanitary regulations with regard to killing and eating animals, partook largely of meat, and were amongst the most vigorous people of their day. We find in modern Europe that those nations who take the most animal food are the strongest; and amongst ourselves, it is just in proportion as we give our labourers animal food, or wages to procure it, that they are stronger and better able to do their work. It is vain for a man to expect to get through intellectual or physical labour without an abundant supply of the material of thought and of physical power, and I have shewn you that animal food is one of the readiest means of affording this supply."

Passing on to what forms the second course of lectures contained in this volume, relating to the second class of articles of food termed medicinal or auxiliary, we have first a very full account of the nature, production and effects of alcohol and the various drinks which contain it; and our teetotal friends will find that our learned author, whilst fully sensible of the dangers and various abuses attending the use of alcoholic drinks, is not prepared to go with them to the extent of entirely condemning all employment of them; but even regards their very limited consumption as beneficial. He is decided, and somewhat vehement in his condemnation of Homœopathy when it incidentally falls in his way in speaking of the varying effects on the system of different quantities of the same substance:—

> "Such, then," he says, "is the connection between food, medicine, and poison, that all our food may be made medicinal and all our medicines become poisons.
>
> "I need not remind you how such a view as this lays the axe at the root of all pretensions to cure disease by remedies that can exert no influence on the system. If you are eating or drinking, and men tell you they are curing your diseases with infinitesimal doses, don't believe them. Your food is exercising a far more powerful effect on your system than their remedies. The only remedies that can be rationally employed as medicines are those which act as food on the system. If they are capable of increasing or decreasing the vital actions of your bodies, then they may or may not do you good, according to the skill with which they are administered; but away with the folly and imposture that would lead you to believe that the natural actions of your bodies are influenced by agents whose existence cannot be detected by the senses. I know nothing more degrading in the intellectual history of the past, with its witchcraft, charms, amulets, royal touches, and holy waters, than the belief of certain portions of the medical profession and the public in the abracadabra of 'similia similibus curantur,' and the efficacy of infinitesimal doses. You must excuse these expressions, I speak strongly because I feel warmly. I am ever ready to make allowance for the opinions and practice of my medical brethren. The rational treatment of disease involves problems of the highest perplexity, in endeavouring to understand which, two minds, equally anxious to reach the truth, may yet arrive at different conclusions. But such conclusions, arrived at by the painful road in which truth ever leads her votaries, are very different from the ready-made hypothesis which is adopted to get rid of the difficulties of inquiry, and which is acted on regardless of the sacrifice of human life, so long as the selfish object for which it was adopted is attained."

Nor is he very gentle in his treatment (and perhaps their case needs some wholesome severity) of certain eccentric reformers who would, in their zeal for simplicity of food, persuade us to abandon all spice and condiments as something pernicious, and deserving the condemnation of those who would regulate their appetites by reason. Speaking of the extensive consumption of ginger in Great Britain, he adds the reflection:—

> "What folly and madness, what waste and injury, must come of this consumption of condiments and spices, if certain of our philanthropic wiseacres

are to be believed, who, combining the follies of teetotalism and vegetarianism with the delusions of homœopathy, denounce the addition of these substances to our diet."

The lectures on tea and coffee are very interesting, as affording the rational explanation of the fondness of mankind for these beverages, and shewing that both as warm drinks, and on account of the theine or caffeine contained in them, they are really beneficial—liable, indeed, in overdoses, to be injurious, especially to some constitutions; but, on the whole, having so favourable an influence as to be justly accounted among the real blessings of our state of civilization. Our friends who only take a glass of cold water with their breakfast, think themselves, no doubt, very philosophical in their simplicity. They will find, however, both that the warm drink is of real advantage, and that the action of tea and coffee on the nervous system, generally harmless, and often beneficial, gives them a natural hold on the appetites of humanity. The subject of narcotics occupies the last lecture. Dr. Lankester does not think so badly of the use of tobacco as we do. We think if he had seen as much as we have of American tobacco consumers, he would not have doubted the evidence of the injurious effect of the practice; yet we are not much dissatisfied with what he does say, when declining to commit himself to a statement that the use of tobacco is decidedly injurious to health:—

"If you will not, therefore, give up this habit of smoking, from motives of economy, from a sense of its unseemliness, from its making your breath smell, and your clothes filthy from its polluting your hands and your house, and driving women and men from you who do not smoke, I dare not, as a physiologist or a statist, tell you, that there exists any proof of its injurious influence when used in moderation. I know how difficult it is to define that word moderation; and yet, in my heart I believe that every one of you has an internal monitor that will guide you to the true explanation of it in your own case. The first symptoms of giddiness, of sickness, of palpitation, of weariness, of indolence, of uneasiness, whilst smoking, should induce you to lay it aside. These are the physiological indications of its disagreement, which, if you neglect, you may find increase upon you, and seriously embarrass your health."

We must here close our notice of these attractive volumes, recommending them for general perusal, as eminently fitted to inform, improve and entertain the reader.

W. H.

*A History of Infusoria, including the Desmidiaceae and Diatomaceae, British and Foreign.* By Andrew Pritchard, Esq., M.R.I., author of the "Microscopic Cabinet," &c. Fourth Edition, enlarged and revised by J. T. Alridge, M.B., B.A., Lond.; W. Archer, Esq.; J. Ralfs, M.R.C.S.L.; W. C. Williamson, Esq., F.R.S.; and the Author. Illustrated by forty plates. London: Whittaker & Co., Ave Maria Lane. 1861.

This work, in its original form, was the first to make the observations and opinions of Ehrenberg familiar to the British scientific public. It was the first, too, to render accessible to inquirers respectable microscopic figures of numerous minute organisms with which many become familiar through the microscope. It was found useful, and the author has felt it to be his interest to keep it before the public. The earlier editions contained what are now accounted great errors, at that time universally prevalent, as well as many deficiencies which it is now not difficult to supply. One subject upon which opinion has greatly changed, is the proper limit between the kingdoms of organised nature. What he had previously on high authority described as animals, Mr. Pritchard now sees good reason to regard as vegetables. This change causes him some embarrassment. It is manifestly desirable that the field of his labours should be about the same as it was formerly, yet this now implies its including low forms both of animal and vegetable life, and yet precludes his undertaking a complete investigation of all the lowest groups belonging to either or both kingdoms. His very title, preserved from former editions, is no longer properly applicable. The idea of including *Desmidiaceae* and *Diatomaceae* in Infusoria, is somewhat startling, as the latter term has always been employed to express minute microscopic animals; whilst it is the authors doctrine, in conformity with the general opinion at present, that the two former families belong to the vegetable kingdom. But in fact the name *Infusoria* is now applied by the best authorities only to the highest division of *Protozoa;* and it is highly convenient that this limitation should be observed. The work then treats of microscopic animals and vegetables,—but among the former it entirely omits Sponges and Polycystina, not to mention smaller groups; and it neither is nor professes to be an account of the lowest vegetable structures generally, but only treats incidentally of some which have been recently supposed to be animal. The work, then, has not a well-defined field, and is not exactly adapted to students of any one department. Yet we believe, that having produced such a work as was contained in his previous editions, and desiring to carry on his labours in the same direction, our author could not have done better than adopt the plan which he has followed out, as he has secured able assistance in the several departments, and given a great mass of useful and interesting information. We must accept of what he has done as a valuable contribution to science, of great practical use to a large class of investigators, although we feel both the deficiencies and the evils arising from a too great mixture of subjects, and may be disposed to recommend special treatises on the different subjects here brought together, as most likely to promote the progress of knowledge and meet the wants of the students of Nature.

Our author divides his treatise into two parts. 1st. A general history of *Infusoria*, &c., in which their nature, structure, functions, and classification are considered; 2nd. A systematic treatise, in which the families, genera, and species are enumerated and characterized. The first part commences with Ehrenberg's *Bacillariae*, containing *Desmidiaceae*, *Pediastreae* (doubtfully separated from the preceding), and *Diatomaceae*. All these are now very properly treated as vegetables. Perhaps Ehrenberg's name would have been better entirely laid aside, as it was connected with the notion of their animal nature; and as the several orders, if more nearly connected with each other than with some other *Algae*, will form one alliance which should be named according to Lindley's plan. The account of the present state of our knowledge of these orders appears to us to be very satisfactory, and affords great advantages to any one entering upon their study.

The second section is devoted to what are here called *Phytozoa*,—a term intended to express a mixed animal and vegetable nature, under which are included a large part of Ehrenberg's *Anentera*. The group is a very miscellaneous one, and confessedly not natural. We give the author's reasons for adopting it, in his own words: "In the opinion of the majority of modern writers, the *Phytozoa* are in general undistinguishable from unicellular *Algae*, among the different families of which they consequently seek to distribute them; and doubtless the creation of such a group is purely artificial, and cannot be admitted in any attempted philosophical or natural classification of microscopic organisms. However, since so much uncertainty and dispute still prevail on the question of the animal or vegetable nature of very many, and since our knowledge of the phases of existence of a large number is so imperfect, it is really impossible to establish any satisfactory classification. On this account, and also to bring together for convenience sake, a mass of information respecting several collections of beings enumerated among the *Anenterous Polygastrica* of Ehrenberg, difficult or impossible to arrange under any other heading, we resort to this artificial division, and in so doing have the example of Perty and other writers." The collection of the observations and opinions of the most celebrated and trustworthy microscopists on these minute organisms is certainly of great value, and it is at least a considerable advantage to have doubtful and uncertain forms, most of which must now be considered as transient conditions of some of the lowest vegetables, whilst they are described so as to be recognized, and the materials for their study are brought together, carefully separated from beings whose animal character is generally admitted, and which are to be considered as members of the lowest sub-kingdom or branch of the animal kingdom. When we see the number of Ehrenberg's genera, and even families, which are now found to be only successive transformations of some of the lower *Algae* in the progress of their development, we cannot but acknowledge and rejoice in the bright light thrown upon so obscure a subject, affording the greatest encouragement to persevering labour and patient research.

The third section, *Protozoa,* is equal in extent to the two preceding, and contains a full and careful account of observations and opinions in relation to this great division of minute creatures. They are divided into the sub-sections *Rhizopoda* and *Ciliata,* which last division corresponds to *Infusoria* in the limited sense now given to it by many naturalists. In his general table, the author assigns their place among *Rhizopoda* to *Polycystina, Thalassicollida,* and *Spongiada,* of which groups—lest his subject matter should be too much extended—he has omitted any further notice. Respecting them, we will only suggest that whilst all that is known of them points out *Polycystina* as true *Rhizopoda,* the sponges (*Porifera* or *Amorphozoa*) appear to constitute a division of equal rank with *Rhizopoda* and *Ciliata* (Infusoria), whilst there are strong reasons for regarding *Thalassicollida* as only a sub-division of sponges.

In this slight indication of the nature of the contents of an extentensive and elaborate work, we must avoid minute criticism, ecpecially of views which are rather recorded than adopted by the authors. The great merit of the work is as an abstract and summary of what has been done upon an extensive and most curious subject of inquiry, and in consequence of this merit, no worker with the microscope would willingly remain without it. The perfection of his means for observing minute objects is to little purpose if he cannot assign to them a position, and obtain some insight into what is known or believed of their nature and affinities, and he could scarcely find elsewhere any similar collection of the objects which may occur to his notice.

The fourth section is devoted to *Rotatoria* or *Rotifera*, the wheel animalcules, and contains a full and highly interesting account of their structure, mode of life, and the various plans proposed for their classification. The discussion respecting their affinities is given at some length. We have the arguments of Leydig to prove them to be a section of *Crustacea;* the reply of Vogt, maintaining their connection with *Vermes;* the speculation of Gosse, on their resemblance to insects, which we must regard as very fanciful; and the novel view of Huxley, according to which we are to place them with *Annelida*, *Echinodermata*, *Trematoda*, *Turbellaria*, and *Nematoidea*, as a group of the lower *Annulosa*, under the name of *Annuloida*. Believing that we are justified in maintaining Cuvier's sub-kingdoms of *Articulata* and *Radiata*, notwithstanding the great changes recently proposed, that on the one hand *Coelenterata* is entirely unnatural, and on the other hand the separation of the jointed-limbed from other articulated animals is unjustifiable, we agree both with Leydig and Vogt in considering the *Rotifera* as exhibiting an articulate structure, though of the lowest character, and we would settle the dispute as to whether they belong to *Crustacea* or *Annulata*, by making them a distinct class of the articulate sub-kingdom, which will thus contain: 1. *Arachnida;* 2. *Insecta*, of which *Myriapoda* is to be accounted a sub-class; 3. *Crustacea*, including *Cirrhopoda;* 4. *Annulata*, of which *Entozoa* constitute a sub-class; 5. *Rotifera*, which, as the lowest form of the articulate series, exhibit analogies with the lowest mollusca (*Polyzoa*) and with embryonic states of the higher *Radiata* as well as with *Protozoa*.

Another short section, the fifth, is devoted to the *Tardigrada*, which are, we think, rightly treated as a very low form of *Arachnida*. In all the classes of articulate animals, whilst a common type may, in our opinion, be well recognised, the range of development is very extensive and varied, so that animals of very low organisation appear in the same class with others representing the highest development consistent with the type. The first comparison of a Mygale or a Scorpion with a Mite or a Tardigrade, would hardly suggest any affinity; but further study brings us acquainted with common characters, and leads us to view them as parts of a series in which amidst the greatest variety of development an uniform type of structure is observable.

The systematic history of the several tribes occupies about half the volume, and is invaluable to the practical microscopist, especially when it is considered that the descriptions of the objects are aided by forty closely filled plates, each containing on an average not less than fifty-five subjects beautifully engraved. Such a collection of minute organisms admirably represented, as many times the cost of this work would not enable us to obtain elsewhere. W. H.

# TRANSLATIONS AND SELECTED ARTICLES.

## EXPERIMENTS ON THE MIGRATION OF ENTOZOA.

BY MM. A. POUCHET AND VERRIER.

(*Translated from the Comptes Rendus of May,* 1862.)

Many of our readers are acquainted with the modern views respecting the transformations of Entozoa, as taught by Van Beneden, Von Siebold, Küchenmeister, &c. The recent researches of two eminent French naturalists, MM. Pouchet and Verrier, creating some doubts on the subject, we copy a translation from the *Comptes Rendus* for May, 1862, giving an account of their experiments; and as we find that Van Beneden has replied, and these writers have attempted further to justify their views in the same publication, we shall continue the subject as the materials come to hand:—

"In a work published by one of us in 1859, a close comparative examination was made of the doctrines of those observers, who in Germany and Belgium had occupied themselves with the subject of the metamorphoses of the Entozoa and their peregrination through the living organism. The obvious result of this examination was to excite very weighty doubts in every thoughtful mind. M. Davaine, in his remarkable *Traité des Entozoaires,* also says that the conclusion in his mind, from the agreement in the facts and the divergence in the opinions of the experimenters, was 'that the question still demands sound criticism and fresh researches.'

"One observer states that, on nine different occasions, he has succeeded in producing *Taeniae* in the intestine of the dog, by causing it to swallow some *Caenuri* of the sheep. It will be seen that we have also been as successful as this experimenter, and that, in fact, it is the great amount of this success that has given rise to our doubts—we have occasionally reaped more than we have sown.

"But before giving an account of our experiments, let us recal briefly what are the Entozoa upon which they have been instituted. The first is the *Caenurus cerebralis,* a vesicular, polycephalous worm, common in the sheep, in which its presence causes the disease termed 'staggers.' The second is *Taenia serrata,* a cestoid worm, extremely abundant in the dog.

"According to the experiments above referred to, this is what takes place:—The dogs devour the heads of the diseased sheep, and the *Caenuri* are by this means introduced into their stomachs. Having reached this locality, each of the polycephalous helminths separates itself from the parent cyst, elongates enormously, and becomes a *Taenia.* The entozoon returns to the sheep in this wise:—When the *Taeniae* of the dog have attained their full development, the rings which they throw off are passed with the excrement, fall upon the grass, and are swallowed by the ruminant. Soon afterwards the ova contained in these segments are hatched in the intestines of the sheep, giving birth to microscopic larvae, which perform what may truly be termed a prodigious journey. From their native seat they force a route into the interior of the head, and, in the course of the journey, are obliged to penetrate through the most varied living tissues—the base of the skull even does not stop them. Instinctively they find one of the openings, and tear through the resisting tissue which fills it up. Having thus finally reached the brain of the sheep, they take up their abode in it, and there produce the *Caenurus* by which the host will infallibly be destroyed. This closes the cycle of existence of the helminth, and the shepherd's dog incurs the grave suspicion of infecting the flock committed to his charge.

"Nevertheless, however great may be the complications attending a migration of this kind from one animal to another, and the subsequent journey through its tissues, if it is shown actually to take place, however mysterious the proceeding may appear, logically we are bound to admit its reality. But it is precisely at this point that we meet with, we will not say insurmountable, but with, at any rate, enormous difficulties. Let us see what these are.

"The *Caenurus cerebralis,* according to V. Siebold, Van Beneden, and other naturalists, would be the larva of *Taenia serrata.* But, on the other hand, this *Taenia serrata,* according to Küchenmeister, Van Beneden, Baillet, and V. Siebold himself, would appear to be the product of *Cysticercus pisiformis*, or of *Cysticerus cellulosae,* and *C. tenuicollis*, according to what V. Siebold further says.

"Here we find ourselves in the utmost embarrassment. It must be allowed, however, that zoologists have exhibited great ingenuity in this matter, if they have not been very exact. Immediately a *Taenia* is met with in any carnivorous animal whatever, the evil is at once imputed to his victim. The cat derives its worms from the rats and mice it devours ; the wolf and the dog find theirs in the rabbits and sheep ; man is indebted to the pig. But a scrupulous examination of the facts excites some doubts with respect to all this. It may be asked, for instance, how is it that the sheep, which does not eat the flesh of any animal, sometimes has its intestine filled with such a multitude of *Taeniae* as to have it completely obstructed by them? In an epizootic malady, which carried off many sheep in the neighbourhood of Rouen, in 1852, this was the case in almost every instance. If the tapeworms find themselves so well off in the intestine, why should the larva of some of them quit that locality, and be obliged to take a compulsory journey to the brain?

"The importance of this question, as regards agriculture, has not escaped M. Le Roy, Préfet of the Seine-Inférieure ; and by him we have been instigated to experiment on a large scale on this grave subject.

"Several causes have evidently contributed to throw a degree of uncertainty on the results of experiments of this kind. In the first place, must be placed the natural frequency of the Entozoa which are employed upon the animals to which we profess to communicate them.

We may notice, also, the circumstance that certain physiologists are accustomed to administer worms at several doses, and at more or less distant intervals—a course which allows of all kinds of interpretations. Lastly, we must not leave out of account the unsuccessful results, which have not always been recorded.

"But, let us not delay with these logical considerations; let us see what experiment teaches, which is alone competent to pronounce a positive judgment.

"We will, once for all, state that we have taken the greatest precaution to induce precision in our experiments. Thus, when we have sought to implant *Caenuri* of the sheep into other animals, we have not been content simply to administer them *en masse*, as has been done by various experimenters. In order to obtain accurate results, we have determined, on every occasion, the number of the heads or *scolices* which have been given, by which means we have been able to decide, with unusual precision, with respect to certain results which, in any other way of proceeding, might have led us to erroneous conclusions. Again, whenever we have made use of these same *scolices*, we have taken pains to assure ourselves that their development was as far advanced as possible, and that they were actually alive.

"Physiologists have grievously erred in not giving comparative tables, showing the length of their experiments, and the size of the Entozoa which they have found. The consequence is, that we sometimes observe inexplicable differences in the length of the Entozoa found on inspection after death.

"In a dog which had been made to swallow some *Caenuri* sixteen days before, we found a certain number of *Taeniae* not more than 2 millimètres long, whilst others were 20. After a similar interval of time, an experimenter even obtained some *Taeniae* which had reached the length of 80 millimetres. In another case, at the end of twenty-three days, we found in one and the same dog, *Taeniae* 4 millimetres long, and others, which had reached the enormous length of 60 centimetres. Is it possible that the *scolices* of the *Caenuri* implanted on the same vesicle, having the same degree of development, and absolutely of the same age, after having been introduced into the intestine, should exhibit, in so short a time, such a prodigious difference of size, from 4 to 60 millimetres? It is inconceivable. If we had followed the usual plan, and administered *Caenuri* at differemt times, such a result would apparently have afforded an evident demonstration.

But, following the plan we did—one both more rational and more rigorous—it seems calculated only to give rise to doubt.

"If, however, in other experiments, we compare the number of Caenurus-scolices administered with that of the *Taeniae* met with, the same uncertainty under which we labour will also be experienced by all serious thinkers. It is impossible, in this case, to reject the evidence of ciphers.

"In one experiment, we administered to a dog 60 heads of *Caenurus*. Eleven days afterwards, on examining the body, we found 36 *Taeniae* in the intestine. In another, 60 *scolices* were also given, and at the end of eleven days 51 *Taeniae* were discovered. This shows nothing. But in a third experiment, in which a dog was also made to take 60 *Caenurus* heads, when it was killed, sixteen days afterwards, we found 78 *Taeniae* in the intestine—that is to say, 18 more than we had administered This is inexplicable.

"Another experiment afforded results of such a nature as to raise still deeper doubts. We gave 100 *Caenurus* heads to a sucking puppy, which was carefully secluded in our laboratory. When killed, twenty days afterwards, we found in the intestine 237 Tapeworms, varying in size from 4 to 60 centimètres—a result doubly perplexing, because we found 137 *Taenias* more than we had sown, and because, having administered *scolices* from the same vesicle, and in the same stage of development, we found, at the end of no more than twenty days, the inexplicable difference of length of from 4 to 60 centimetres. This appears to us calculated to afford ground for serious objections.

"Other experiments have afforded only absolutely negative results. A full-grown Danish dog swallowed at one time a *Caenurus* having about 100 *scolices* on its surface. Killed at the end of forty-five days, it did not afford a single *Taenia*. Another full-grown dog devoured a *Caenurus* upon which were counted about 100 lively *scolices*. When killed, forty-five days afterwards, it afforded also only a negative result.

"But if we admit that some serious doubts still require to be dissipated with respect to the transmigration of the *Caenurus cerebri* of the sheep to the intestine of the dog, we are infinitely more decided with respect to the peregrination of the ova of the *Taeniae* of the carnivora to the brain of the ruminant.

"Our experiments were made upon two lambs, to each of which we administered ten segments of *Taenia serrata,* all of which contained a number of perfectly-matured ova, in which might be distinguished the embryo with its hooks. The sheep, which had been carefully selected as in perfect health, never presented the slightest symptom of 'staggers.' Experimenters say that the symptoms of this disease are ordinarily manifested from the fifteenth to the twentieth day; but in order to avoid any precipitancy, we kept our animals for four months. Though still in perfect health, they were then killed, in order to ascertain whether the brain contained any vestige of *Caenurus;* but on the autopsy that organ was found perfectly sound. Consequently, in these cases there had been no transportation of the progeny of the *Taeniae* of the dog to the brain of the sheep.

"Considering, therefore, the doubts which arise when we regard attentively the assertions of experimenters, and those also which arise upon a rational examination of the proofs, and lastly, the results of our experiments, we do not hesitate to assert that the offspring of the *Taenia* of the dog never reaches the brain of the sheep.

"But although we deny thus strongly the transmission of the entozoon of the dog to the brain of the sheep, we should not be astonished —without admitting that this is the normal course—to find that it may be possible that the *Caenuri* of the latter animal were individual *Taenias,* which have undergone an arrest of development, owing to the situation in which they have been born, and which aborted *Taenias,* being placed by the experimenter in a more propitious place, there elongate themselves, and attain a larger size than they present in the brain. This opinion has been already sustained.

"We are continuing our experiments, and shall, without doubt, be able to arrive at a solution of this interesting problem."

# ON A HYÆNA-DEN AT WOOKEY-HOLE, NEAR WELLS.

BY W. BOYD, ESQ., B.A., F.G.S.,
BURDETT-COUTTS GEOLOGICAL SCHOLAR IN THE UNIVERSITY OF OXFORD.

[The account of the contents of a cave near Wells, in Somersetshire, England, which we extract from the last number of the *Quarterly Journal of the Geological Society,* is not only interesting to the geologist and palaeontologist, but from the discovery of human relics, very highly so to the antiquarian and ethnologist. As all our readers may not have access to the original, we copy the paper, omitting the minute discription of the organic remains, of which, however, we give the list.]

Of all the ossiferous caverns of this country which have from time to time been explored since 1821, there are none, perhaps, which form so exact a parallel to the Hyæna-den at Kirkdale as that which I bring before your notice this evening.

It is situated at Wookey-Hole, a village on the southern flanks of the Mendips, and about two miles to the north-west of Wells. The ravine in which it was discovered is one of the many which pierce the dolomitic conglomerate, or petrified sea-beach of the Permian (?) age, still underlying its ancient sea-cliffs of Mountain-limestone, and overlying the lower slopes of the Mendips. Open to the south, it runs almost horizontally into the mountain side, until closed abruptly northwards by a perpendicular wall of rock, 200 feet or more in height, ivy-covered, and affording a dwelling-place to innumerable jackdaws. Out of a cave at its base, in which Dr. Buckland discovered pottery and human teeth, flows the River Axe, in a canal cut in the rock. In cutting this passage, that the water might be conveyed to a large paper-mill close by, the mouth of the Hyena-den was intersected some ten years ago; and from that time up to December, 1859, it was undisturbed save by rabbits and badgers; and even they did not penetrate far into the interior, or make deep burrows. Close to the mouth of the cave the workmen (employed in making this canal) found more than 300 Roman coins, among which were those of the usurper Allectus and Commodus. When Mr. Williamson and myself began our exploration in 1859, about 12 feet of the entrance of the cave had been cut away, and large quantities of the earth, stones, and animal remains had been used in the formation of an embankment for the stream which runs past the present entrance of the cave. Of the animal remains, some found their way to the British Museum and the Museum of the Somerset Archæological Society at Taunton; but the greater portion were either thrown away or scattered among the private collections of the neighbourhood. According to the testimony of the workmen, the bones and teeth formed a layer about 12 inches in thickness, which rested immediately on the conglomerate-floor, while they were comparatively scarce in the overlying mass of stones and red earth. The workmen state also that at the time of the discovery of the cave the hill-side presented no concavity to mark its presence. When we began our exploration, so completely was the cave filled with *débris* up to the very roof, that we were compelled to cut our way into it. Of the stones scattered irregularly through the matrix of red earth, some were angular, others water-worn; all are derived from the decomposition of the dolomitic conglomerate in which the cave is hollowed. Near the entrance, and at a depth of five feet from the roof, were three layers of peroxide of manganese, full of bony splinters; and passing obliquely up towards the southern side of the cave, and over a ledge of rock that rises abruptly from the floor, further inwards they became interblended one with another, and at a distance of 15 feet from the entrance were barely visible. In and between these the animal remains were found in the greatest abundance.

While driving this adit, we found an irregular piece of flint, which had evidently been chipped by human agency, and a water-worn fragment of a belemnite, which probably had been derived from the neighbouring Marlstone-series. Bones and teeth of *Rhinoceros tichorhinus*, *Cervus Bucklandi*, of other species of Deer, Irish Elk, Mammoth, *Hyæna*, *Ursus spelæus*, Wolf, Fox, and Horse, rewarded our labours; and at the mouth of the cave, and cemented together by stalagmite, were frogs' remains. Remains of *Felis spelæa* also were found at the time of the discovery of the cave, and are at present in the Museum of the Somerset Archæological Society. The teeth preponderated greatly over the bones, and the great bulk were those of the Horse. The Hyæna-teeth also were very numerous, and in all stages of growth, from the young unworn to the old tooth worn down to the very gums. Those of the Elephant had belonged to a young animal, and one had not been used at all. The hollow bones were completely smashed and splintered, and scored with tooth-marks, while the solid carpal, tarsal, and sesamoid bones were uninjured, as in the case of the Kirkdale Cave. The organic remains were in all stages of decay, some crumbling to dust at the touch, while others were perfectly preserved and had lost very little of their gelatine.

In 1860 we resumed our excavations; and, in addition to the above remains, found satisfactory evidence of the former presence of Man in the cave. One white flint spear-head, of rude workmanship, one chert arrow-head, a roughly chipped piece of chert, a round flattened piece of chert, together with various splinters of flint, which had apparently been knocked off in the manufacture of some implement, rewarded our search. Two rudely fashioned bone arrow-heads were also found, which unfortunately have since disappeared; they resembled in shape an equilateral triangle with the angles at the base levelled off. All were found in and around the same spot, between the dark bands of manganese, in contact with some Hyæna-teeth, at a depth of four feet from the roof, and at a distance of 12 feet from the present entrance.

That there might be no mistake about the accuracy of the observations, I examined every shovelful of *débris* as it was thrown out by the workmen; while the exact spot where they were excavating was watched by Mr. Williamson. The white flint spear-head was picked out of the undisturbed matrix by him; the remainder of the implements were found by me in the earth thrown out from the same place. Thus there can be no doubt as to their exact position; and error of observation is rendered very improbable. Two of the specimens are similar in workmanship and general outline, though not in size, with two of the typical forms found at Amiens and Abbeville, which Evans terms respectively spear-heads and sling-stones. The spear-head is of white-flint: in outline, size, and workmanship it resembles a beautiful semi-transparent quartz-rock specimen from the burial-mounds of North America, in the possession of Dr. Acland. The bone arrow-heads resembled most strongly in size and outline a flint arrow-head, also from the burial-mounds of North America, and in the possession of Dr. Acland. The chert arrow-head is dissimilar to any that I have seen. A splinter, which is bounded on one side by a straight cutting edge, appears to me to have been used as a knife, and to have been intentionally chipped into its present form for that purpose.

But what inference can be drawn from these signs of Man's presence in a Hyæna-den filled with unmistakeable remains of a fauna now extinct in Europe? Was the fabricator a contemporary of the British Cave-bear, Rhinoceros, Mammoth, and their congeners? Or did he leave his instruments in the cave at a time posterior to that of the other creatures whose remains are associated with them in the Post-glacial period? If the former be answered in the affirmative, Man, instead of having appeared on the earth some 6000 or 7000 years ago, must have existed at a time anterior to the glacial epoch, and at a time when the relations between land and water were altogether different,—a period that we cannot sum up in years. But if the latter, the great antiquity of the implements is by no means proved, and they may have belonged to any period anterior to that of the Saxons. The facts of the case, to my mind at least, lead but to one conclusion—that these implements were deposited in the cave during the Preglacial period. The cave at the time of its discovery (assuming the statement of the workmen to be true) was completely blocked up, so that the ravine-side presented no concavity to indicate its presence; there were no traces of disturbance posterior to the filling up of the cave either on the spot where they were found, or as we were driving our adit thither. And, as 12 feet of the former mouth of the cave have been cut away, we must double the distance from the present entrance to the spot itself, which will thus be 24 feet. The motive certainly has yet to be assigned that would induce a savage to excavate a trench 24 feet long with his miserable stone implements, and consequently with great labour; and, having excavated it, again to fill it up to the very roof with the *débris* which he had removed—earth, stones, and animal remains. The absence of charcoal, pottery, and human bones precludes the idea of the cave ever having been a place of sepulture, as was the cave close by, also one on the northern flanks of the Mendips at Barrington-Comb, and a third in Cheddar Cliffs.

But, on the other hand, it may be said that the fact of their being found in and around the same spot is a weighty argument in favour of their introduction in the Post-glacial times. Had they been subjected to violent watery action, they would, like most of the animal remains, have been scattered confusedly through the matrix, and would not have been found as they were left by their former possessor. They would moreover have lost their sharp edges. On this point, indeed, they, as well as a large number of the animal remains, where slender processes and points of bone are left uninjured (as, for instance, the palatine process of the right maxilla of a Wolf), agree in shewing that violent watery action had a very small share in filling the cave.

I should infer that, as the dolomitic conglomerate of the roof and walls gradually yielded to the attacks of the carbonic acid in the air, the *débris* was gradually accumulated at the same time that the Hyænas from time to time brought in the remains of their victims. On this hypothesis the fact of the occurrence of these implements in the same place, coupled with the absence of all traces of an entrance having been effected posterior to the filling up of the cave, is easily explicable; as also is the fact of the bones and teeth being confusedly scattered, and as yet in no instance water-worn. This gradual process may at times have been varied by floodings, by which a large quantity of earthy sediment, derived from higher levels, may have been introduced, as now in a cave close by, in which sediment similar in every respect to the red earth of the bone-cave is deposited during a rainy season. Had the numerous large stones been put in motion by water in the cave, they would soon have ground down the animal remains to an impalpable dust.

Thus, indeed, the discovery of these implements in the same spot, so far from proving that they were introduced subsequently to the other remains, adds additional testimony to the method by which the cave was filled,—that it was filled gradually and by causes still in operation, and not by any great cataclysm, by which the contents of numerous bone-caves are supposed to have been introduced. And the only alternative left us is to believe that they were deposited during the time that the *Rhinoceros tichorhinus*, Irish Elk, and Cave-bear inhabited the British Isles, and before the great submergence of land in the Northern Hemisphere.

In April, 1861, we resumed our excavations; and, as we made our way inwards, found that the cave began to narrow, and ultimately to bifurcate; one branch extending vertically upwards, while the other, which is undisturbed, appeared to extend almost horizontally to the right hand. As we reached the middle constricted passage, the teeth became fewer, while the stones were of larger size than any we had hitherto discovered. The great majority of the gnawed antlers of Deer were found at this part, also the posterior half of a cervine skull, the right maxilla of *Canis lupus*, and, what is more remarkable, a stone with one of its surfaces coated with a deposit apparently of stalagmite: this, however, was much lighter than stalagmite, and not so good a conductor of heat; and, on analysis, I found that it consisted of phosphate of lime, with a little carbonate, and a very small portion of peroxide of manganese. Doubtless the surface of the stone, covered with phosphate of lime, formed part of the ancient floor of the cave, and hence was coated with excrement, while he lower part, being imbedded in the earth on the floor, was not so coated. This deposit may, perhaps, explain the absence of round balls of *Al-*

*bum græcum*, which, assuming that the cave at the time was more damp than that at Kirkdale, would be trodden down on the floor by the hyænas, instead of presenting a rounded form. The stone also itself exhibits tooth-marks, and probably was gnawed by the hyænas, like the necrosed antlers, for amusement. Dogs are very fond of exercising their teeth in this way. This discovery also proves that violent watery action had but small share, if any, in filling the cave; for in that case the soft *Album græcum* would have been removed from the stone.

The section made in cutting this passage presented irregular layers of peroxide of manganese, full of bony splinters, and in general covered by a layer of bones in various stages of decay. These layers disappeared in the upper portion of the passage. There were masses of prismatized stalactites scattered confusedly through the matrix. After excavating the vertical branch as far as we dared (for the large stones in it made the task dangerous), we were compelled to leave off, having penetrated altogether only 34 feet from the cave's mouth. In this vertical branch, the bones, stones, and red earth are cemented together by carbonate of lime,—a circumstance which added materially to the difficulty of the excavation.

A short distance from the entrance the cave gives off a lateral branch to the left, which tends obliquely upwards, and is abruptly closed by stalagmite. This forms a marked contrast to the rest of the cave, being covered with stalactite and stalagmite, and free from *débris;* while the other parts are full of *débris*, and at the same time free from any but the merest traces of carbonate of lime, except in the case of the vertical branch above mentioned, where, however, it does not assume a stalagmitic form.

There are numerous caverns in the vicinity which, in all probability, are connected with the one under notice, and which, to say the very least, are parts of the same great system, and all open upon the same ravine. And even this probably is but a cavern unroofed by the chemical action of the carbonic acid in the air, by which the insoluble carbonate of the stone is changed into the soluble bicarbonate, and conveyed away atom by atom. It probably was the main trunk fed by numerous tributaries, now represented by caverns, all of which are dry, with the exception of that at the head of the ravine, through which the drainage still passes, though not to the same degree as formerly.

On measuring the cave we found that the maximum height of the entrance was 8 feet and the width 36 feet; in the interior the maximum height was 9 feet.

In conclusion, I will only add that, after carefully weighing the facts of the case, on the site of our excavation, I cannot but infer, from the evidence afforded by this cave alone, that Man was a contemporary of the gigantic *Ursus spelæus*, the Hyæna, the Mammoth, and their congeners; and I feel convinced that the cave was filled with its present contents, not by a violent cataclysm, but by the ordinary operations of nature now, as then, in progress; with this difference only, that the remains of Foxes and Badgers are now being entombed in the caverns still open in the district, instead of the extinct preglacial fauna.

*List of Mammalian Remains.*

HYÆNIDÆ. *Hyæna spelæa*, 4 jaws, 49 teeth, left ilium, 2 metacarpals, portion of right rib, and right maxillary.

CANIDÆ. *Canis vulpes*, 4 humeri, 3 ulnæ, 5 tibiæ, left radius.

*Canis Lupus*, right maxillæ with P. M. 4 and incisors 2, right humerus.

URSIDÆ. *Ursus spelæus*, 3 molars, 2 canines, left humerus.

SOLIDUNGULA. *Equus*, os calcis, 4 astragali, metacarpal, metatarsal, distal end of tibia, upwards of 70 molars, 7 incisors, one canine.

MULTUNGULA. *Rhinoceros tichorhinus*, 3 proximal ends of ulnæ, astragalus, phalanges, 29 molars.

BOVIDÆ. *Bos primigenius*, 2 ossa calcis (right), astragalus, phalanx, portion of shaft of femur, scapho-cuboid, 2 molars.

CERVIDÆ. Teeth, antlers, and various fragments.

*Megaceros Hibernicus*, 7 molars, fragment of jaw containing M. 1, 2, 3.

*Cervus Bucklandi*, 2 antlers (skull?).

*C. Guettardi*, 2 antlers.

*C. Tarandus* (?), (skull?), (antler?).

*C. Dama* (?), fragments of antlers.

PROBOSCIDIA. *Elephas primigenius*, 2 second molars, portion of tusk, innumerable splinters.

## SCIENTIFIC AND LITERARY NOTES.

### THE SOCIAL SCIENCE ASSOCIATION.

[We find the following reports in a London weekly newspaper, and avail ourselves of them in the absence of more complete information on a subject of great and general interest.]

The Houses of Parliament were turned to a new use on Saturday evening, June, 7th, the Social Science Association having converted them to the purposes of an evening party. In private life the master of the house is often turned out of his library and other haunts when the mistress gives a ball, and his studious leather armchair made use of by young ladies eating ices in the intervals of dancing. So it was on Saturday at Westminster, and fair young girls in opera cloaks spread themselves all over the sombre green benches of the House of Commons, sitting in the Speaker's chair, or enacting Sergeant-at-Arms for a few brief moments in that functionary's huge *fauteuil.*

We cannot pretend to give even a catalogue of the papers read during the week. Our space admits but of a very brief selection.

In the International Department, Dr. Travers Twiss has delivered what should have been an inaugural address. It was a comprehensive digest of the history of international law.

In the section of jurisprudence, Sir Fitzroy Kelly, who presided, has delivered an address, containing an eloquent comment on the constitution of England, but strongly condemning the confused state into which the common and statute law have been brought, and urging the necessity of codification.

The relations of trade and the means of settling differences between masters and workmen have engaged a large share of the attention of the social economy section; and it is fair to add that the masters do not have it all their own way in the controversy. The workmen find plenty of advocates.

Mr. J. Heywood has read a paper on "College Scholarships," in which he described the character of the examinations by which such appointments are obtained at Oxford and Cambridge.

*Public Amusements.*—Mr. J. Hyde has read an interesting paper upon the subject of the amusements of the working classes. He stated that places of public amusement derived their support from the craving of the people for the excitement of vivid and novel sensations, that animal excitements obtained the largest support, and that of intellectual amusements the following order was observed:—First, periodical literature, then the drama, then concerts, negro entertainments and burlesque performances, then panoramas and exhibitions, then lectures and libraries, and lastly, discussion and other classes. It was necessary to provide better and higher class amusements to meet the wants of the working classes, or vicious and unscrupulous men would supply the deficiency for them, and it was necessary that those amusements should partake something of the form and character of those at present in vogue. He recommended, therefore, the establishment of small garden allotments in the suburbs of all towns for the labouring classes, and that flower, fruit, and vegetable shows should be encouraged amongst them. He recommended also the establishment of bowling greens, skittle grounds, quoit grounds, and cricket clubs, detached from public-houses, and where neither beer nor strong liquors should be introduced. Men were not to be won to Temperance by tea-drinking and experience-relating meetings, and he believed more was to be done in the cause in the way he had pointed out than by any other means. With regard to the drama, Colley Cibber once said that two theatres were as many as London could find performers for or audiences to support, whereas there were now no less than sixteen, beyond the vast number of public recitations and readings from plays, affording a mild dose of theatrical representation, which those were willing to attend who would not think of going to see the enactment of stage plays, with the improving adjuncts of scenery and costume. The dramatic form was singularly consistent with our nature, and the only objection was to those plays which had an immoral tendency, or which were vicious and stupid, or often both. The great influence of amusements upon the character of the people, and the dearth of proper amusements, claimed for this question the best consideration of the congress.

The Rev. H. Solly found a strong desire amongst the working classes for elocutionary entertainments, and considered that the indulgence of that desire was beneficial in keeping men from public-houses, and from the pernicious influences of twopenny and fourpenny theatres. The penny concerts introduced in some large towns were also deserving of encouragement; but he regretted the increased number of those houses where music was made only the inducement to drink.

Mr. W. Pare, of Dublin, thought the friends of teetotalism had lost a fine opportunity of extending their principles by their adherence to a negative policy, instead of proposing something positive. The working man must have some amusement, and drunkenness was often resorted to from no inherent vice, but from want of something better to do.

Mr. A. Ryland referred to the success which had attended the establishment of penny lectures and penny classes in connection with working men's institutions in Birmingham, to which all classes went. The experiment of parks had been tried there for the amusement of the people, and with signal success, and they were going to try the experiment of workmen's halls, which he understood to mean gin palaces without the gin.

Mr. Cassel remarked that the Temperance Society had not been neglectful in providing amusements for its followers. In Glasgow they had established Saturday night concerts, which were regularly attended by upwards of three thousand people, principally of the working classes, and it was necessary that these temperance amusements should be extended to counteract the influence of music halls, which were becoming a great and gigantic evil.

The Rev. Dr. Beale bore testimony to the success that had attended the plans adopted for the proper amusement of the people in the agricultural districts, and recommended as the result of his experience that lectures to the labouring classes should combine as far as possible amusement with instruction.

Lord Brougham said nothing could be more important than the subject under discussion, affecting as it did both the health of the body and the health of the mind: and he was glad to hear that the appreciation of its importance was not confined to the towns.

*University Degrees for Women.*—Miss Frances P. Cobbe, on Tuesday, read a paper on "Female Education, and how it would be affected by University Examinations." After alluding to the special wants of women at this time, and the advantages which an improved education would give them, Miss Cobbe controverted the popular idea that a cultivated woman was likely to be a less good wife and mother than an ignorant one, or that, as Sydney Smith said, "a woman's love for her children depended on her ignorance of Greek, and she would be likely to desert an infant for a quadratic equation." Two of the noblest instances of woman's home virtue and woman's philanthropic devotion were Mary Somerville and Mary Carpenter, the one the head of all her sex in science, and the other learned enough to have taught Homer and Virgil at eighteen. A classical education did not make a woman masculine. It was as absurd to teach a girl French because a boy learned Latin, as to to make her eat mutton because the boy ate beef. The assimilation of mental and bodily food both suited the natural constitution. A woman's mind is made by the Creator wholly different from that of a man, and in everything else she does, art, learning, or philanthropic labour, these differences come out. She works not like a man, from without, by force of will and legislative power, but from within, by persuading and inspiring. To educate a woman to the utmost is only more and more to educe her womanliness; to make her more, not less, a woman. A sound and solid education is even more needful for her than a man, her natural quickness leading her to shallowness and hastiness of conclusions. University examinations, which have long been admitted to be so useful for men, can hardly prove less so for women. That of London, in particular, offers special facilities for their admission, and we may hope that the late resolution of half the Senate to reject them will ere long be reconsidered. London University will assuredly suffer no derogation from following the course of the schools of Alexandria, where Hypatia held the first chair of philosophy then existing in the world; and in that of the University of Padua, where women taught and learned besides Galileo, Petrarch, and Columbus. In conclusion Miss Cobbe begged both men and women to put aside the prejudices which the obnoxious and ludicrous ideas attached to that popular ogress the strong-minded female, brought upon all subjects connected with the claims of women. In the old times of chivalry, to help a woman in distress was deemed the highest honor for the bravest knight. Assuredly it is not less an honor now to aid the whole sex to rise to a better and nobler life, and to develop more perfectly, because more freely and fully, that form outward which God has also made in His own image —a divine and holy thing. The conclusion of the paper was followed by the heartiest applause.

The President: I may accept, I suppose, that acclamation as a wish that we had the power of conferring degrees—(hear)—and if we had, I should be most happy to propose that Miss Cobbe receive from us the degree of M.A.—(cheers and laughter)—mistress of the art of discussing a subject with sound reason, with infinite grace, and with perfect propriety—(hear). On one point only I should wish to make an observation, and that is to confirm the statement of Miss Cobbe as to the possibility of the union of the most perfect domestic virtues with the highest intellectual cultivation. I cannot venture with so many ladies present, to open a discussion on the subject—(laughter). I should be sorry to baulk any lady—(laughter)—but I hope what has been said has been so full and satisfactory that they will accept it as a perfect statement of their case.

At the meeting on the evening of the same day, Mr. Shaen moved a resolution to the effect that the council should represent to the Senate of the University of

London the desirableness of their undertaking the duty of affording women an opportunity of testing their attainments in the more solid branches of learning. He referred to the case of Miss Garrard, who, through her father applied to the Senate to be examined, and received a reply that under the charter they had no power to comply with her request. He read portions of the charter, and endeavoured to shew that the difficulty was more technical than real, and that the Senate would readily get over it as soon as they were desirous to admit women.

Dr. Hodson seconded the resolution.

Mr. H. Chester said it was necessary for national interests that means should be found without delay for improvement in the education of women, and they must consist in a great degree of a tribunal for testing their requirements and granting certificates or degrees. He, however, could not agree that the best mode of accomplishing the object at the present time would be to force the duty upon the University of London. There could be no doubt whatever that the founders of the University and the Government authorities who issued the charter did not contemplate that degrees should be granted to women; and he could not but think that if the University were at once to grant women the degrees of bachelor of arts, master of arts, and doctor, they would bring on themselves an amount of ridicule which would retard rather than advance the object in view. That object could be obtained in a much more practical way. What they wanted was an university specially designed for women alone, and he thought that this association had resources at hand which would enable it to establish such an institution. He referred to the success which had attended the examination of females in different branches of knowledge by the Society of Arts, and suggested that the association should appoint a special committee to deal with the subject.

Dr. Foster thought that women would prefer having university degrees, equal to those obtained by men, to certificates from the College of Precentors or the Society of Arts.

The resolution, after some more discussion, was withdrawn, and the following carried unanimously:—"That this meeting is of opinion that means ought to be provided for testing and attesting the education of women of the middle and higher classes, and requests the council of the association to take such measures as they may deem expedient for the attainment of this object."

*A Ladies' Parliament.*—The chief interest on Wednesday was centred in the Social Economy Section, in which, under the presidency of Lord Brougham, a ladies' parliament was held to discuss the question of employment for their sex. The section was crowded during the whole day by a throng of ladies, who filled, not only the area of the court, but the jury-box and the seats for counsel, and gave the chamber very much the appearance of the College of the "Princess" with its rows of "fair girl graduates in their golden hair." The gentlemen (says the *Times*) were in such a miserable minority that they were scarcely visible, and if they were not to be seen they certainly took good care not to make themselves heard. Whether they were too craven to utter their real sentiments, or whether they were converted by the soft voices of the orators, we cannot say; but, if the old adage holds good, consent must be inferred from silence. Some of the ladies, owing to the amplitude of their skirts, found not a little difficulty in getting into the tribune, and, when there, were at first rather nervous, dropping their voices to a confidential whisper, and searching for scraps of paper which were never to be found. But they soon regained their confidence, and spoke out with a distinctness and animation which might put most young curates, and even some barristers, to the blush. The proceedings commenced with a paper by Miss Emily Davies, on "Medicine as a Profession for Women," which was read by Mr. Russell Gurney. The Secretary communicated a paper by the Rev. J. S. Howson, advocating the official employment of women in works of charity. Miss Bessie R. Parkes next delivered in a clear, firm voice, an interesting address, partly prepared and partly extempore, on "The Balance of Public Opinion on Woman's Work." She expressed an opinion that we are now passing through a stage of civilisation in which women are excluded from many occupations in which they are qualified to excel, while they are confined to others, such as factory work, for which they have no aptitude, and which tend to interfere with the true sphere of woman—the household. Miss Emily Faithfull followed with a paper on some of the drawbacks connected with the present employment of women. She attributed the inaccuracy and want of persistent attention with which women were charged to defective education. Habits of unintermittent industry could not be expected to follow a girlhood of negligence. She suggested the establishment of a tribunal to examine and certify as to the attainments of women, and protested against the idea that marriage should be a mere refuge for the destitute. The system of training which she advocated would, in her opinion, promote matrimony, because it would furnish women with accomplishments which would render them valuable acquisitions in the houses of those prudent bachelors of limited means who were afraid to mate with extravagant and useless "fine ladies." Mrs. Inglis, in discussing the papers which had been read, observed, amidst some applause, that it was a woman's own fault if employment was denied her. The sex were so ridiculously afraid of being deemed "strongminded" or "unladylike" that they shrank from doing true woman-like work. Lord Brougham remarked that the talent of women in debate had been clearly proved, and appealed to some of the gentlemen present to exhibit their powers in the same way; but, whether from timidity or gallantry, the invitation was not responded to. In answer to questions, Miss Faithfull stated that she had more applications for work in her printing establishment than she could meet. Mrs. Jellicoe read a paper suggesting the employment of women as spupervisors over their own sex in factories. Miss Barbara Corbett reported the progress of the Dublin Society for the Employment of Educated Women. Since last year two hundred pupils have attended the classes for book-keeping, law-writing, sewing with the machine, cutting out clothing, &c. A lucid and able essay on the legal disabilities of women was contributed by Miss Tabor. A paper read by Miss Florence Hill, shewing that there is a sphere in the colonies for educated women, was read by Mrs. A. Hill; and the report of the Women's Employment Society by Miss E. Faithfull.

*Thursday's Sittings.*—The Reformatory section was occupied with an animated discussion on the Permissive Bill advocated by the United Kingdom Alliance. In the other sections interesting papers on various subjects were read. In the evening a soirée was given to the members and their foreign guests by the Fishmonger's Company. The wires of the Submarine Telegraph Company were connected with the hall, and messages were despatched from the president, council, and others, to the Burgomaster of Brussels, the Lord Lieutenant of Ireland, and the Lords Provost of Edinburgh and Glasgow, to which replies were received before the guests separated. The following cities and towns were also spoken with:—Paris, Basle, Vienna, Warsaw, Cracow, Brussels, Berlin, Copenhagen, and Hanover.

### THE INTERNATIONAL PHILANTHROPIC CONGRESS.

The sittings of the International Philanthropic Congress were commenced on Monday, the 9th of June, at Burlington House, under the presidency of Lord Shaftesbury. In his inaugural address, his lordship stated that the object of the Congress was to deal with subjects of private benevolence not requiring the interposition of legislative enactment. In an able manner he pointed out how much there was to be done in this direction.

On Tuesday, the education of neglected children was treated in an earnest, kindly spirit, by Miss Carpenter, in a paper which she read to the Congress. She drew a graphic picture of the "Young City Arab," reckless of punishment and privation, and precocious in the accomplishments of vice, earning his claim to be comfortably lodged and well fed for four years at the public expense, and then discharged in first-rate condition to pursue with renewed zest and energy his pernicious career. She insisted it was the duty of society to assume the place of a parent towards those children who had either lost or been deserted by their natural guardians. The State ought to supply the authority and a portion of the funds for such action, and leave the rest to private benevolence. Care must, of course, be taken to prevent such institutions as Mettray and Rye House from serving as a premium to undutiful parents, and it was only just that parents should be compelled to contribute towards the education no less than to the maintenance of their offspring. The child had also a right to be preserved from the ill-usage as well as the neglect of its parents. As far as possible a domestic character should be given to the schools for neglected children, and industrial should be combined with elementary education. Miss Carpenter also urged that the State ought to assist the ragged-schools.

On Thursday, the following papers were on the programme for the day:—Miss Carpenter, "On the Education of Neglected Children;" M. de Perrégaux-Montmollin, "Rapport sur la fréquentation des écoles primaires dans le Canton de Neufchatel;" Mr. H. Roberts, F.S.A., "Suitable Literature for the Working Classes;" Mr. W. Spottiswoode, F.R.S., "An Account of the Schools and other arrangements for the Workpeople at Her Majesty's Printing-office, London;" Miss Florence Nightingale, "Army Sanitary Reform under the late Lord Herbert;" Dr. Guy, "On the Rate of Mortality prevailing in the General Hospitals of London;" M. le Dr. Guggenbuhl, fondateur et directeur de l'asile pour les crétins à l'Abendburg (canton de Berne), "Sur la nécessité d'une Statistique Européenne du Crétinisme et de l'Idiotie;" Mrs. Fison, "Women's Work in Sanitary and Social Reform;" M. le Comte de Larnage, fondateur de l'asile agricole pour les épileptiques à Tain (Drôme), "L'Epilepsie considérée au point de vue social et charitable;" Mr. E. Chadwick, C.B, "Recent Sanitary Improvements in England, and their Results;" M. G. Rollin-Jacquemyns, "De l'institution des prix de propreté à Gand;" Mr. H. R. Roberts, F.S.A., "Improvements in the Dwellings of the Working Classes."

### BALBIANI ON TRUE SEXUAL REPRODUCTION IN THE INFUSORIA.

The *Infusoria* have long been known to multiply by spontaneous fission, external germination, and the production, internally, of variously formed bodies, which many observers, somewhat hastily, have described under the name of "embryoes." The phenomena of "encysting," "conjugation," and "alternate generation" (so called), which these animals frequently exhibit, and the relation, real or supposed, between such processes and their various modes of propagation, have, from time to time, afforded subject-matter for not a little controversy.

Now, however, the whole aspect of this subject has been changed, and for the vagueness which, less than four years ago, characterised all attempts to explain the generative functions of the Infusoria, has been substituted that clear and complete survey of their leading phenomena, which science has just received from the pen of M. Balbiani. In his excellent summary, just brought to a conclusion, a concise, yet sufficiently detailed account is given of the structure of the sexual apparatus, male and female, among the principal sub-divisions of the class. The changes which this apparatus undergoes in the course of its development—the evolution of the essential elements to which it gives rise, and many other particulars of interest, are all in their turn described with laudable minuteness and precision. Compelled, at times, to correct the mistakes of others, he in no wise shrinks from avowing the errors into which he himself fell at the commencement of his inquiries; nor does he hesitate to point out the difficulties of interpretation which beset him at each successive stage of their progress. Perhaps future investigators may, in some degree, require a more qualified statement of views which M. Balbiani, in common with most of his readers, now considers beyond the reach of cavil. Yet, even with this restriction, it does not seem too much to say that a single observer has done more to establish on a secure basis a right knowledge of the sexual phenomena of the Infusoria than the collective body of his predecessors in the same field of inquiry.—*From the Quarterly Journal of Microscopical Science.*

MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—APRIL, 1862.

*Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 m. 33 s. West. Elevation above Lake Ontario, 108 feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resul't. Direction. | Velocity of Wind. | | | | | Rain in inches. | Snow in inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | Mean. | 6 A.M | 2 P.M | 10PM | ME'N | | 6 A.M. | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A. M. | 2 P. M. | 10 P. M. | | 6 AM. | 2 PM. | 10 P.M. | Re-sul't. | ME'N | | |
| 1 | 29.872 | 29.900 | 29.892 | 29.8888 | 33.1 | 38.5 | 31.3 | 34.23 | — 2.00 | .174 | .173 | .152 | .164 | .92 | .74 | .86 | .83 | N N W | W S W | N E | N 50 E | 4.5 | 2.8 | 4.0 | 2.54 | 5.77 | ... | ... |
| 2 | .728 | .334 | .230 | .4337 | 34.5 | 38.5 | 40.3 | 39.27 | + 2.63 | .173 | .199 | .209 | .192 | .86 | .85 | .84 | .80 | E b N | E | S b W | S 62 E | 12.2 | 17.0 | 11.2 | 3.71 | 15.58 | 0.010 | ... |
| 3 | .610 | .727 | .860 | .7447 | 40.3 | 45.4 | 36.0 | 40.25 | + 3.23 | .209 | .169 | .144 | .179 | .84 | .55 | .68 | .72 | W S W | W | W N W | N 77 W | 17.0 | 14.2 | 9.4 | 8.07 | 10.24 | ... | ... |
| 4 | .870 | .836 | .684 | .7842 | 32.0 | 32.7 | 32.0 | 32.30 | — 5.03 | .158 | .143 | .143 | .149 | .87 | .76 | .79 | .81 | N N E | E b S | E | N 86 E | 10.2 | 14.0 | 19.0 | 15.47 | 15.90 | ... | 0.1 |
| 5 | .235 | .319 | .561 | .3783 | 35.3 | 39.9 | 33.8 | 36.40 | — 1.32 | .170 | .164 | .158 | .168 | .83 | .66 | .81 | .79 | E | W | W N W | S 87 W | 21.0 | 18.2 | 4.2 | 6.45 | 12.51 | 0.355 | 0.1 |
| 6 | .654 | .821 | — | — | 31.3 | 34.2 | — | — | — | .152 | .131 | — | — | .86 | .66 | — | — | W b S | W | NW b N | N 69 W | 14.5 | 20.2 | 3.4 | 11.85 | 12.03 | ... | Inp. |
| 7 | .984 | .886 | .786 | .8738 | 20.1 | 30.9 | 26.6 | 26.17 | —12.25 | .091 | .141 | .105 | .117 | .85 | .81 | .73 | .82 | W N W | E | N E | N 72 E | 0.5 | 7.0 | 6.5 | 8.44 | 9.41 | ... | ... |
| 8 | .718 | .653 | .610 | .6467 | 29.5 | 29.1 | 30.6 | 29.90 | — 8.82 | .121 | .126 | .138 | .132 | .74 | .78 | .80 | .79 | E b N | E b N | E b N | N 80 E | 22.0 | 17.5 | 23.6 | 19.97 | 19.99 | ... | ... |
| 9 | .554 | .535 | .639 | .5765 | 30.9 | 35.3 | 33.8 | 33.22 | — 5.82 | .104 | .127 | .166 | .131 | .69 | .61 | .85 | .69 | E b N | E b N | N E | N 72 E | 21.0 | 19.0 | 7.0 | 11.17 | 11.83 | ... | ... |
| 10 | .780 | .914 | .969 | .9007 | 29.8 | 42.1 | 35.6 | 35.67 | — 3.75 | .140 | .152 | .134 | .146 | .84 | .56 | .65 | .70 | N N E | S S W | N W | N 32 E | 7.5 | 3.5 | 2.5 | 2.71 | 5.00 | ... | ... |
| 11 | 30.092 | 30.062 | 30.116 | 30.0923 | 32.7 | 44.6 | 32.7 | 37.08 | — 2.65 | .135 | .162 | .143 | .145 | .73 | .54 | .76 | .66 | N | S E b S | W N W | N 20 E | 7.4 | 4.5 | 3.0 | 1.70 | 4.79 | ... | ... |
| 12 | 30.086 | 30.056 | 29.922 | 30.0167 | 37.1 | 43.5 | 37.4 | 39.73 | — 0.40 | .174 | .117 | .135 | .128 | .78 | .41 | .60 | .53 | E N E | E | E b N | N 85 E | 7.8 | 13.5 | 11.0 | 10.42 | 10.43 | ... | ... |
| 13 | 29.829 | 29.778 | — | — | 37.8 | 41.7 | — | — | — | .165 | .175 | — | — | .72 | .65 | — | — | E | E b N | N E b E | N 77 E | 12.8 | 11.0 | 2.2 | 6.74 | 6.99 | 0.020 | ... |
| 14 | 29.763 | 29.778 | .821 | 29.7922 | 41.7 | 54.0 | 43.9 | 46.37 | + 5.63 | .218 | .282 | .244 | .247 | .82 | .67 | .86 | .79 | E b N | E S E | S E b S | N 88 E | 2.0 | 4.5 | 1.5 | 3.84 | 4.18 | ... | ... |
| 15 | .866 | .852 | .810 | .8393 | 43.5 | 53.3 | 47.5 | 49.25 | + 8.20 | .259 | .312 | .264 | .288 | .92 | .76 | .80 | .82 | N E b E | E N E | E | N 81 E | 5.5 | 9.4 | 6.0 | 6.11 | 6.17 | Inp. | ... |
| 16 | .810 | .698 | .671 | .7210 | 45.4 | 61.6 | 53.3 | 54.32 | +12.83 | .263 | .393 | .344 | .338 | .86 | .71 | .84 | .79 | E N E | S E | E | S 67 E | 6.0 | 3.6 | 3.0 | 2.58 | 3.34 | 0.005 | ... |
| 17 | .701 | .773 | .763 | .7472 | 52.7 | 64.1 | 53.6 | 56.85 | +15.10 | .351 | .459 | .373 | .384 | .88 | .76 | .91 | .82 | S W b S | W | NW b N | N 89 W | 4.6 | 8.4 | 3.8 | 4.27 | 6.93 | 0.130 | ... |
| 18 | .697 | .503 | — | — | 46.1 | 48.2 | — | — | — | .282 | .328 | — | — | .90 | .97 | — | — | N N E | E b N | W b N | N 74 W | 2.0 | 2.2 | 22.0 | 5.25 | 8.98 | 0.115 | ... |
| 19 | .742 | .754 | .807 | .7725 | 39.9 | 45.7 | 37.0 | 41.30 | — 1.05 | .181 | .211 | .149 | .177 | .73 | .68 | .67 | .68 | W N W | S W b S | NW b N | N 49 W | 6.8 | 9.8 | 8.0 | 4.54 | 7.82 | ... | ... |
| 20 | .810 | .801 | — | — | 35.3 | 42.8 | — | — | — | .164 | .134 | — | — | .80 | .48 | — | — | W | S S E | E N E | N 87 E | 7.5 | 12.0 | 5.0 | 5.44 | 7.48 | ... | ... |
| 21 | .598 | .466 | .299 | .4310 | 37.0 | 37.8 | 37.4 | 37.40 | — 5.70 | .167 | .217 | .213 | .199 | .76 | .95 | .95 | .89 | E N E | E | E | N 82 E | 12.5 | 20.0 | 23.5 | 18.93 | 18.95 | 1.555 | ... |
| 22 | .078 | .109 | .284 | .1673 | 38.5 | 44.6 | 36.0 | 39.83 | — 3.53 | .225 | .274 | .162 | .217 | .96 | .93 | .76 | .87 | E | S b W | NW b W | N 64 W | 11.0 | 0.4 | 27.4 | 11.68 | 14.04 | 0.020 | ... |
| 23 | .427 | .586 | .734 | .5947 | 30.6 | 32.0 | 30.6 | 31.12 | —12.58 | .152 | .150 | .144 | .147 | .89 | .83 | .85 | .84 | W | W N W | W b S | N 68 W | 19.6 | 32.0 | 8.2 | 17.30 | 18.11 | ... | Inp. |
| 24 | .763 | .791 | .821 | .8005 | 30.2 | 43.9 | 33.1 | 35.92 | — 8.08 | .112 | .163 | .108 | .126 | .67 | .56 | .56 | .59 | N N W | S W b S | N | S 55 W | 12.8 | 6.0 | 12.5 | 3.97 | 9.84 | ... | ... |
| 25 | .875 | .876 | .909 | .8878 | 30.2 | 42.1 | 29.5 | 35.00 | — 9.40 | .128 | .082 | .120 | .111 | .76 | .30 | .74 | .58 | N N E | S E b E | Calm. | N 85 E | 4.2 | 10.5 | 0.0 | 4.42 | 5.37 | ... | ... |
| 26 | .948 | .992 | .970 | .9767 | 33.4 | 44.6 | 38.1 | 39.87 | — 4.83 | .126 | .154 | .126 | .138 | .66 | .51 | .55 | .56 | N N E | E S E | NE b E | S 87 E | 4.5 | 10.2 | 4.5 | 3.99 | 5.40 | ... | ... |
| 27 | .978 | .868 | — | — | 38.8 | 47.9 | — | — | — | .195 | .250 | — | — | .82 | .74 | — | — | E b N | E N E | E | N 76 E | 10.0 | 10.0 | 7.5 | 7.17 | 8.08 | ... | ... |
| 28 | .591 | .606 | .638 | .6140 | 45.0 | 54.7 | 49.3 | 48.10 | + 2.70 | .230 | .262 | .241 | .235 | .77 | .60 | .68 | .70 | S E b E | S S W | N W | S 81 W | 3.6 | 14.4 | 7.5 | 5.35 | 10.76 | 0.025 | ... |
| 29 | .744 | .746 | .795 | .7627 | 39.6 | 51.1 | 40.3 | 43.97 | — 1.77 | .184 | .131 | .158 | .157 | .75 | .35 | .63 | .57 | N N W | NW b N | NW b W | N 38 W | 7.0 | 19.0 | 5.0 | 9.30 | 9.54 | ... | ... |
| 30 | .781 | .710 | .630 | .7023 | 37.4 | 52.2 | 44.6 | 45.45 | — 0.60 | .170 | .212 | .162 | .188 | .76 | .54 | .54 | .61 | N | E b S | E b N | N 87 E | 1.0 | 6.2 | 10.0 | 6.30 | 7.77 | ... | ... |
| ... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ... | ... |
| M | 29.7286 | 29.7184 | 29.7288 | 29.7258 | 36.02 | 44.09 | 37.77 | 39.56 | — 1.43 | .177 | .199 | .177 | .184 | .80 | .66 | .75 | .73 | ...... | ...... | ...... | ...... | 9.30 | 11.37 | 8.75 | ...... | 9.77 | 2.235 | 0.2 |

Highest Barometer . . . . . . . 30.117 at 8 a. m. on 12th. } Monthly range=
Lowest Barometer . . . . . . . 29.076 at 8 a. m. on 22nd. } 1.041 inches.
Self-registering Ther. { Maximum temperature . . . . 68°0 on p.m. of 17th } Monthly range=
{ Minimum temperature . . . . 14°5 on a.m. of 7th } 53°5
{ Mean maximum temperature . . 46°34 } Mean daily range=12°91
{ Mean minimum temperature . . 33°43 }
{ Greatest daily range . . . . . . . 23°5 from a. m. to p. m. of 30th.
{ Least daily range . . . . . . . . 4.2 from a. m. to p. m. of 21st.
Warmest day . . . 17th ...Mean Temperature . . .=56°85 } Difference=30°68
Coldest day . . . . 7th ...Mean Temperature . . .=26°17 }
Maximum { Solar . . . . . . . . . . 82°4 on p.m of 17th } Monthly range=
Radiation { Terrestrial . . . . . . . 5°0 on a. m. of 7th } 77°.4

Aurora observed on 5 nights, viz.: 1st, 3rd, 10th, 15th, and 29th; Possible to see Aurora on 16 nights; Impossible on 14 nights.

Snowing on 4 days; depth, 0.2 inches; duration of fall, 3.8 hours.

Raining on 10 days; depth, 2.235 inches; duration of fall, 43.7 hours.

Mean of cloudiness=0.65; above the average, 0.07. Most cloudy hour observed, 8 a.m.; mean=0.74; least cloudy hour observed, 10 p.m.; mean=0.53.

*Sums of the components of the Atmospheric Current, expressed in Miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 1891.49 | 737.55 | 3656.66 | 2292.73 |

Resultant direction, N. 50° E.; Resultant Velocity, 2.48 miles per hour.
Mean velocity 9.77 miles per hour.
Maximum velocity 33.4 miles, from 1 to 2 p.m. on the 23rd.
Most windy day 8th—Mean velocity 19.99 miles per hour. } Difference 16.65 miles.
Least windy day 16th—Mean velocity 3.34 miles per hour. }
Most windy hour, 1 to 2 p.m.—Mean velocity, 11.50 miles per hour. } Difference
Least windy hour, 7 to 8 p.m.—Mean velocity, 7.48 miles per hour. } 4.02 miles.

2nd. Thunder, vivid lightning, and slight rain, 6 to 9 p.m. (first thunder storm of season).—4th. Snowing and hailing 8.30 to 10.30 p.m.; wind high and squally.—7th. Solar halo during forenoon; lunar halo from 7 20 p.m.; wild pigeons observed—9th. Lunar halo between 8 and 9 p.m., imperfect.—11th. Lunar halo from [illegible] p.m., imperfect.—14th. Lunar halo at midnight, imperfect.—15th. Lunar Corona 10 to 11 p.m.; frogs croaking loudly.—16th. Solar halo during forenoon; sheet lightning and distant thunder 7.30 p.m.; lunar halo at midnight; butterflies observed.—17th. Swallows observed.—18th. Wetting fog 6.50 a.m. to 1 p.m.; violent gale from 7 p.m.—23rd, 24th, 25th, and 26th. Ice on exposed vessels and shallow pools at 6 a.m.—24th. Solar halo at 4 p.m., imperfect.—27th.—Solar halo during afternoon.—28th. Ground fog 6 a.m.—30th. Hoar frost and thin ice at 6 a.m.; solar halo at 8 a.m.

The amount of the Eastern Compound of the Wind for the month of April, 1862, was the greatest recorded in any April during the last fifteen years.

## COMPARATIVE TABLE FOR APRIL.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | Excess above Average, (41°0). | Maximum observed. | Minimum observed. | Range. | No. of days. | Inches. | No. of days. | Inches. | Resultant. Direction. | Resultant. Velocity. | Mean Velocity |
| 1840 | 42.4 | + 1.4 | 65.9 | 25.3 | 40.6 | 14 | 3.420 | 2 | ... | ... | ... | ... |
| 1841 | 39.2 | — 1.8 | 62.9 | 22.1 | 40.8 | 3 | 1.370 | 3 | ... | ... | ... | 0.51lbs |
| 1842 | 43.1 | + 2.1 | 89.5 | 21.6 | 67.9 | 8 | 2.740 | 2 | ... | ... | ... | 0.57 " |
| 1843 | 40.9 | — 0.1 | 70.0 | 15.1 | 54.9 | 7 | 3.185 | 3 | 0.1 | ... | ... | 0.46 " |
| 1844 | 47.5 | + 6.5 | 74.5 | 17.2 | 57.3 | 10 | 1.515 | 1 | Inp. | ... | ... | 0.24 " |
| 1845 | 42.1 | + 1.1 | 66.0 | 14.8 | 51.2 | 11 | 3.290 | 4 | 1.5 | ... | ... | 1.00 " |
| 1846 | 44.0 | + 3.0 | 79.4 | 24.4 | 55.0 | 10 | 1.300 | 2 | 1.3 | ... | ... | 0.55 " |
| 1847 | 39.2 | — 1.8 | 65.6 | 8.4 | 57.2 | 8 | 2.870 | 2 | 4.0 | ... | ... | 0.59 " |
| 1848 | 41.3 | + 0.3 | 65.4 | 26.5 | 38.9 | 5 | 1.455 | 1 | 0.5 | N 77 W | 1.46 | 4.89ms. |
| 1849 | 39.0 | — 2.0 | 70.9 | 23.2 | 47.7 | 10 | 2.655 | 2 | 1.7 | N 43 W | 3.14 | 7.50 " |
| 1850 | 37.9 | — 3.1 | 63.2 | 18.2 | 45.0 | 7 | 4.720 | 2 | 1.1 | N 39 W | 1.12 | 7.64 " |
| 1851 | 41.3 | + 0.3 | 59.2 | 25.8 | 33.4 | 11 | 2.295 | 3 | 1.2 | N 14 E | 2.52 | 8.07 " |
| 1852 | 38.2 | — 2.8 | 53.8 | 19.8 | 34.0 | 6 | 1.990 | 4 | 9.4 | N 23 E | 2.44 | 6.68 " |
| 1853 | 41.9 | + 0.9 | 65.7 | 27.0 | 38.7 | 10 | 2.625 | 1 | 1.0 | N 12 W | 1.95 | 5.20 " |
| 1854 | 41.0 | 0.0 | 65.1 | 22.3 | 42.8 | 12 | 2.683 | 4 | 2.7 | N 50 E | 2.57 | 6.81 " |
| 1855 | 42.4 | + 1.4 | 63.8 | 12.2 | 51.6 | 8 | 2.030 | 3 | 1.6 | N 36 W | 3.99 | 7.57 " |
| 1856 | 42.3 | + 1.3 | 69.8 | 15.1 | 54.7 | 13 | 2.780 | 3 | 0.1 | N 29 E | 1.61 | 6.05 " |
| 1857 | 35.4 | — 5.6 | 51.9 | 10.0 | 41.9 | 10 | 1.755 | 11 | 12.9 | N 60 W | 4.15 | 10.24 " |
| 1858 | 41.5 | + 0.5 | 61.5 | 23.8 | 37.7 | 13 | 1.642 | 2 | 0.1 | N 14 W | 1.64 | 9.57 " |
| 1859 | 39.5 | — 1.5 | 62.1 | 23.9 | 38.2 | 9 | 2.527 | 8 | 1.2 | N 36 W | 2.33 | 10.79 " |
| 1860 | 39.5 | — 1.5 | 60.7 | 19.7 | 41.0 | 11 | 1.2[illegible]2 | 5 | 0.3 | N 37 W | 4.10 | 10.30 " |
| 1861 | 42.0 | + 1.0 | 62.3 | 26.2 | 36.1 | 12 | 1.619 | 4 | 6.9 | N 37 E | 2.31 | 8.90 " |
| 1862 | 39.6 | — 1.4 | 64.1 | 20.1 | 44.0 | 10 | 2.235 | 4 | 0.2 | N 50 E | 2.48 | 9.77 " |
| Results to 1861. | 40.98 | ... | 65.87 | 20.12 | 45.75 | 9.5 | 2.398 | 3.3 | 2.51 | N 19 W | 2.04 | 7.87 |
| Diff. fr 1862 | —1.42 | ... | — 1.77 | — 0.02 | — 1.75 | + 0.5 | — 0.163 | + 0.7 | — 2.31 | ... | ... | +1.90 |

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST—MAY, 1862.

*Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 min. 33 sec. West. Elevation above Lake Ontario, 108 feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resultant Direction. | Velocity of Wind. | | | | | Rain in Inches. | Snow in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | MEAN. | 6 A.M | 2 P.M. | 10 P.M | ME'N | | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M. | 2 P.M. | 10 P.M. | | 6 A.M | 2 P.M | 10 P.M | Result. | ME'N | | |
| | | | | | ° | ° | ° | ° | ° | | | | | | | | | | | | ° | | | | | | | |
| 1 | 29.560 | 29.541 | 29.464 | 29.5143 | 43.5 | 41.7 | 40.7 | 42.27 | — 4.15 | .231 | .218 | .250 | .235 | .82 | .82 | .93 | .87 | E N E | E b N | E b N | N 82 E | 8.8 | 19.5 | 17.8 | 14.34 | 14.37 | 0.255 | ... |
| 2 | .417 | .406 | .461 | .4335 | 40.3 | 48.6 | 45.0 | 44.37 | — 2.35 | .251 | .276 | .258 | .257 | 100 | .80 | .86 | .88 | E b N | S E b S | SW b W | S 20 W | 7.5 | 6.2 | 14.5 | 4.34 | 6.77 | 0.135 | ... |
| 3 | .490 | .528 | .551 | .5233 | 42.5 | 50.0 | 45.7 | 46.43 | — 0.62 | .244 | .204 | .268 | .239 | .89 | .55 | .87 | .76 | S S W | W S W | W | S 62 W | 5.5 | 17.0 | 3.2 | 6.68 | 8.03 | 0.007 | ... |
| 4 | .501 | .397 | — | — | 43.9 | 51.5 | — | — | — | .226 | .325 | — | — | .79 | .85 | — | — | N N W | E b S | N | N 45 W | 0.5 | 7.0 | 6.0 | 1.36 | 5.94 | ... | ... |
| 5 | .431 | .441 | .472 | .4492 | 41.0 | 47.9 | 46.1 | 46.45 | — 1.28 | .210 | .230 | .234 | .230 | .81 | .69 | .75 | .73 | N N W | S W | NW b N | N 39 W | 7.8 | 6.5 | 11.5 | 11.10 | 12.27 | ... | ... |
| 6 | .477 | .386 | .370 | .4105 | 43.9 | 61.6 | 51.1 | 52.35 | + 4.32 | .218 | .247 | .209 | .218 | .75 | .44 | .54 | .56 | N W | N W b N | W | N 53 W | 16.5 | 22.0 | 11.2 | 16.38 | 17.14 | ... | ... |
| 7 | .435 | .566 | .692 | .5770 | 44.6 | 51.3 | 41.7 | 45.90 | — 2.52 | .130 | .130 | .183 | .145 | .43 | .34 | .69 | .48 | N W | N W b N | N N W | N 30 W | 11.8 | 10.6 | 8.5 | 10.34 | 10.43 | ... | ... |
| 8 | .770 | .719 | .690 | .7220 | 38.1 | 60.1 | 52.2 | 51.97 | + 3.18 | .179 | .343 | .214 | .237 | .77 | .66 | .54 | .61 | W N W | S b W | W b S | N 80 W | 6.8 | 12.0 | 2.5 | 6.22 | 8.19 | ... | ... |
| 9 | .683 | .589 | .522 | .5895 | 53.3 | 77.5 | 61.9 | 65.48 | +16.32 | .270 | .387 | .221 | .286 | .66 | .41 | .39 | .45 | W N W | N W b W | W N W | N 57 W | 10.5 | 18.6 | 11.8 | 16.23 | 16.33 | ... | ... |
| 10 | .545 | .547 | .735 | .6265 | 58.7 | 69.9 | 52.9 | 60.33 | +10.83 | .296 | .295 | .266 | .271 | .59 | .40 | .65 | .52 | N W b W | N W b N | N | N 26 W | 11.2 | 23.5 | 9.5 | 15.09 | 15.81 | ... | ... |
| 11 | .874 | .886 | — | — | 45.4 | 54.0 | — | — | — | .162 | .221 | — | — | .52 | .52 | — | — | N N W | S b W | Calm. | S 47 W | 5.5 | 6.5 | 0.0 | 1.64 | 3.24 | ... | ... |
| 12 | .858 | .701 | .671 | .6948 | 46.1 | 66.3 | 59.4 | 58.03 | + 7.87 | .225 | .406 | .297 | .304 | .72 | .62 | .58 | .63 | Calm. | S b W | W b S | S 38 W | 0.0 | 11.5 | 1.5 | 4.85 | 5.65 | Inp. | ... |
| 13 | .528 | .590 | .654 | .5917 | 59.0 | 46.1 | 46.1 | 50.20 | — 0.37 | .415 | .282 | .282 | .324 | .83 | .90 | .90 | .88 | N N E | E b S | N E b N | N 35 E | 0.5 | 3.0 | 1.5 | 3.14 | 3.98 | 0.160 | ... |
| 14 | .681 | .751 | .741 | .7345 | 46.8 | 59.1 | 46.1 | 52.43 | + 1.55 | .206 | .268 | .225 | .234 | .64 | .53 | .72 | .60 | N b E | E | E b N | N 69 E | 4.5 | 10.6 | 3.4 | 5.37 | 6.85 | ... | ... |
| 15 | .805 | .783 | .756 | .7778 | 55.1 | 65.7 | 50.4 | 56.20 | + 4.92 | .226 | .260 | .278 | .253 | .52 | .44 | .76 | .57 | N b E | S E b E | N E b N | N 73 E | 3.5 | 4.2 | 3.2 | 1.53 | 2.73 | ... | ... |
| 16 | .803 | .730 | .669 | .7313 | 51.5 | 68.4 | 54.4 | 59.93 | + 8.35 | .304 | .467 | .330 | .375 | .80 | .67 | .78 | .72 | N W | S E b S | N E | S 42 E | 0.5 | 3.0 | 1.0 | 0.78 | 1.17 | ... | ... |
| 17 | .673 | .581 | .496 | .5750 | 54.4 | 68.1 | 58.0 | 60.75 | + 8.77 | .330 | .459 | .394 | .391 | .78 | .67 | .82 | .73 | Calm. | E S E | N E b E | S 62 E | 0.0 | 4.8 | 0.2 | 1.73 | 2.03 | ... | ... |
| 18 | .399 | .238 | — | — | 56.9 | 65.2 | — | — | — | .384 | .433 | — | — | .83 | .70 | — | — | Calm. | E b S | W b N | S 89 W | 0.0 | 5.5 | 21.0 | 6.48 | 10.21 | ... | ... |
| 19 | .423 | .499 | .567 | .5070 | 42.5 | 45.0 | 39.2 | 41.87 | —10.75 | .130 | .166 | .207 | .182 | .69 | .55 | .87 | .69 | W N W | W b N | N W b W | N 68 W | 12.5 | 12.8 | 2.5 | 8.35 | 8.55 | ... | ... |
| 20 | .645 | .664 | .665 | .6643 | 34.9 | 48.6 | 41.0 | 44.08 | — 8.93 | .190 | .221 | .184 | .204 | .77 | .64 | .71 | .70 | N b W | S E b S | N E b E | S 73 E | 1.5 | 10.6 | 1.2 | 4.80 | 6.55 | ... | ... |
| 21 | .582 | .385 | .430 | .4520 | 45.7 | 52.6 | 50.8 | 49.25 | — 4.03 | .211 | .300 | .313 | .257 | .68 | .75 | .84 | .81 | E b N | E N E | S W b S | S 58 E | 16.0 | 11.5 | 8.5 | 4.62 | 12.67 | 0.855 | ... |
| 22 | .555 | .657 | .594 | .5972 | 52.6 | 63.0 | 51.1 | 54.37 | + 0.67 | .269 | .362 | .269 | .291 | .67 | .63 | .71 | .68 | W S W | S W | S W | S 69 W | 17.0 | 10.5 | 6.8 | 10.97 | 12.92 | ... | ... |
| 23 | .696 | .786 | .853 | .7885 | 48.6 | 58.3 | 43.2 | 50.45 | — 3.52 | .211 | .151 | .190 | .181 | .61 | .31 | .68 | .52 | W N W | N W b W | N N W | N 55 W | 27.0 | 19.5 | 4.5 | 13.64 | 13.83 | ... | ... |
| 24 | .908 | .836 | .805 | .8535 | 40.3 | 49.7 | 45.7 | 46.07 | — 8.22 | .193 | .197 | .139 | .183 | .77 | .55 | .45 | .58 | N | S b W | N N W | S 7 E | 2.0 | 6.6 | 5.5 | 1.43 | 4.31 | ... | ... |
| 25 | .829 | .768 | — | — | 41.4 | 53.0 | — | — | — | .171 | .282 | — | — | .64 | .58 | — | — | N W b N | S b W | S W | S 15 W | 0.2 | 10.0 | 0.8 | 4.63 | 4.96 | ... | ... |
| 26 | .654 | .503 | .413 | .5210 | 44.6 | 58.7 | 52.9 | 52.38 | — 2.60 | .245 | .263 | .327 | .268 | .83 | .52 | .82 | .68 | E N E | E S E | Calm. | S 30 E | 0.7 | 6.8 | 0.0 | 3.20 | 3.42 | 0.015 | ... |
| 27 | .361 | .3 0 | .430 | .3633 | 55.4 | 69.9 | 50.4 | 58.28 | + 2.98 | .317 | .423 | .238 | .327 | .72 | .58 | .65 | .67 | S b W | N b W | N W b N | N 38 W | 2.0 | 11.6 | 3.8 | 6.03 | 9.58 | Inp | ... |
| 28 | .584 | .590 | .626 | .6032 | 47.5 | 60.5 | 42.8 | 51.23 | — 4.42 | .245 | .197 | .177 | .193 | .74 | .37 | .64 | .53 | N W | N N W | Calm. | N 30 W | 0.5 | 13.2 | 0.0 | 6.65 | 6.78 | ... | ... |
| 29 | .665 | .586 | .545 | .5875 | 41.0 | 62.5 | 55.1 | 55.15 | — 0.80 | .184 | .269 | .195 | .227 | .71 | .46 | .44 | .52 | Calm. | S b W | N N W | S 58 W | 0.0 | 6.5 | 2.0 | 1.36 | 3.22 | ... | ... |
| 30 | .513 | .497 | .500 | .5080 | 54.0 | 58.3 | 54.0 | 55.08 | — 1.17 | .242 | .312 | .222 | .238 | .57 | .63 | .52 | .54 | N N E | E b S | N | E | 1.0 | 3.0 | 4.2 | 1.79 | 2.48 | ... | ... |
| 31 | .573 | .534 | .481 | .5212 | 47.9 | 65.6 | 56.2 | 57.40 | + 0.85 | .211 | .205 | .285 | .242 | .62 | .32 | .63 | .52 | N | E N E | N N E | N 56 E | 0.5 | 3.0 | 2.5 | 3.01 | 3.51 | ... | ... |
| M | 29.6044 | 29.5813 | 29.5846 | 29.5895 | 47.36 | 58.26 | 49.41 | 52.17 | + 0.69 | .239 | .279 | .246 | .253 | .72 | .56 | .70 | .65 | ...... | ...... | ...... | ...... | 5.88 | 10.25 | 5.50 | ...... | 7.87 | 1.427 | ...... |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR MAY, 1862.

Highest Barometer........................ 29.912 at 8 a. m. on 21th } Monthly range =
Lowest Barometer ........................ 29.238 at 2 p. m. on 18th } 0.704 inches.

Self-registing Thermom.
Maximum Temperature ............... 78°5 on p.m. of 9th } Monthly range =
Minimum Temperature ............... 32°4 on a.m. of 8th } 46°1
Mean maximum Temperature ..................... 61°43 } Mean daily range =
Mean minimum Temperature ..................... 42°01 } 19°43
Greatest daily range ............ 37°0 from a. m. to p m. of 9th.
Least daily range.................. 4°8 from a. m. to p. m. of 19th.

Warmest day......... 9th... Mean temperature......... 65°48 } Difference = 23°61.
Coldest day......... 19th... Mean temperature......... 41°87 }
Maximum } Solar.............................. 90°4 on p. m. of 9th } Monthly range =
Radiation. } Terrestrial......................... 21°1 on a. m. of 8th } 69°3
Aurora observed on 5 nights, viz.: 6th, 21st, 23rd, 30th. and 31st.
Possible to see Aurora on 20 nights; impossible on 11 nights.
Snowing on 0 days, depth ... inches; duration of fall, ... hours.
Raining on 8 days,—depth 1.427 inches; duration of fall 23.2 hours.
Mean of cloudiness = 0.43. Below average 0.07.
Most cloudy hour observed, 6 a. m., mean = 0.50; least cloudy hour observed midnight; mean, = 0.36.

*Sums of the components of the Atmospheric Current, expressed in miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 2403.89 | 1122.38 | 1182.77 | 2823.90 |

Resultant direction N. 52° W.; Resultant velocity 2.80 miles per hour.
Mean velocity............................ 7.87 miles per hour.
Maximum velocity .................... 30.2 miles, from 4 to 5 a. m. on 23rd.
Most windy day ...... 6th ............Mean velocity, 17 14 miles per hour. } Difference =
Least windy day......16th ...... .....Mean velocity, 1.17 ditto. } 15.97 miles
Most windy hour ...11 a.m. to noon.........Mean velocity, 11.10 ditto. } Difference =
Least windy hour...midn't to 1 a.m..........Mean velocity 5.00 ditto. } 6.10 miles.

2nd. Dense wetting fog 6 to 8 a. m.; sheet lightning in N. E. at 8 and 9 p. m.—4th Hoar frost at 5 p. m.—6th. Lunar halo 11 p. m. to midnight —8th. Hoar frost and thin ice at 5 30 a.m.; lunar halo at 10 p.m.—12th. Sheet lightning at 9 and 10 p.m.; ground fog at midnight.—16th. Ground fog at 10 p.m.—18th. Sheet lightning at 8 and 9 p.m.—20th. Hoar frost at 5.30 a m.—21st. Thunderstorm, vivid lightning, and heavy rain 4 to 5.20 p.m.; dense fog 5 20 to 6 p.m.—24th. Sharp hoar frost and thin ice at 5.30 a.m.—25th. Hoar frost at 5 a m.; faint solar halo at 6 p.m.—26th. Sheet lightning in S. W. and W. at 10 p.m. and midnight.—29th. Hoar frost at 5 a.m.; solar halo at 10 a.m.—30th. Solar halo from 6 a.m. to noon.

Dew recorded on 9 mornings during this month.

May, 1862, was very dry, comparatively mild, windy, and clear.

### COMPARATIVE TABLE FOR MAY.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | Diff. above aver'ge (51°4). | Max. observed. | Min. observed. | Range. | No. of days. | Inches | No. of days. | Inches | Resultant Direction. | V'y | Mean Force or Velocity. |
| 1840 | 53.8 | + 2.4 | 74.5 | 30.8 | 43.7 | 9 | 4.159 | 0 | ... | ... | ... | ........... |
| 1841 | 50.5 | − 0.9 | 76.2 | 26.6 | 49.6 | 11 | 2.350 | 1 | ... | ... | ... | 0.35 lbs. |
| 1842 | 49.1 | − 2.3 | 74.3 | 30.0 | 44.3 | 7 | 1.275 | 0 | ... | ... | ... | 0.53 |
| 1843 | 49.1 | − 2.3 | 79.6 | 28.9 | 50.7 | 5 | 1.570 | 0 | 0.0 | ... | ... | 0.52 |
| 1844 | 53.6 | + 2.2 | 77.7 | 29.0 | 48.7 | 14 | 5.670 | 0 | 0.0 | ... | ... | 0.30 |
| 1845 | 49.6 | − 1.8 | 76.6 | 29.4 | 47.2 | 8 | 2.300 | 0 | 0.0 | ... | ... | 0.55 |
| 1846 | 55.5 | + 4.1 | 78.1 | 34.3 | 43.8 | 9 | 4.375 | 0 | 0.0 | ... | ... | 0.16 |
| 1847 | 54.4 | + 3.0 | 72.5 | 27.8 | 44.7 | 12 | 2.040 | 0 | 0.0 | ... | ... | 0.29 |
| 1848 | 54.1 | + 2.7 | 78.5 | 31.9 | 46.6 | 13 | 2.520 | 0 | 0.0 | N 40° W | 1.31 | 4.93mls. |
| 1849 | 48.0 | − 3.4 | 72.5 | 32.7 | 39.8 | 16 | 5.115 | 0 | 0.0 | N 1° E | 1.97 | 5.33 |
| 1850 | 47.6 | − 3.8 | 76.3 | 31.1 | 45.2 | 7 | 0.545 | 1 | Inap | N 61° W | 2.05 | 6.32 |
| 1851 | 51.3 | − 0.1 | 73.2 | 28.7 | 44.5 | 12 | 2.950 | 1 | 0.5 | N 32° W | 1.59 | 6.34 |
| 1852 | 51.1 | 0.3 | 73.3 | 34.5 | 38.8 | 7 | 1.125 | 1 | Inap | S 82° W | 0.99 | 4.00 |
| 1853 | 50.9 | − 0.5 | 78.4 | 38.1 | 40.0 | 17 | 4.420 | 1 | Inap | N 2° W | 0.83 | 5.16 |
| 1854 | 52.2 | + 0.8 | 69.0 | 27.6 | 41.4 | 11 | 4.630 | 0 | 0.0 | E | 0.40 | 5.38 |
| 1855 | 53.1 | + 1.7 | 74.8 | 33.9 | 40.9 | 6 | 2.565 | 2 | 0.9 | N 1° W | 2.76 | 5.93 |
| 1856 | 50.5 | − 0.9 | 80.1 | 35.5 | 44.6 | 14 | 4.580 | 1 | Inap | N 4° E | 3.99 | 9.81 |
| 1857 | 48.9 | − 2.5 | 72.5 | 27.9 | 44.6 | 15 | 4.145 | 1 | Inap | N 23° W | 1.14 | 8.13 |
| 1858 | 48.9 | − 2.5 | 65.0 | 35.0 | 31.0 | 17 | 6.367 | 0 | 0.0 | N 42° E | 3.33 | 9.30 |
| 1859 | 55.2 | + 3.8 | 76.2 | 41.5 | 34.7 | 11 | 3.410 | 0 | 0.0 | N 72° E | 1.59 | 5.70 |
| 1860 | 55.5 | + 4.1 | 73.2 | 35.6 | 37.6 | 16 | 1.815 | 0 | 0.0 | N 26° E | 2.66 | 7.17 |
| 1861 | 47.5 | − 3.9 | 72.0 | 29.1 | 42.9 | 12 | 3.580 | 1 | 0.5 | N 47° W | 3.60 | 9.17 |
| 1862 | 52.2 | + 0.8 | 77.8 | 38.1 | 39.7 | 8 | 1.427 | 0 | 0.0 | N 52° W | 2.80 | 7.87 |
| Results to 1861. | 51.39 | ... | 74.80 | 31.83 | 42.97 | 11.5 | 3.241 | 0.5 | 0.10 | N 2° W | 1.49 | 6.63 |
| Diff for 1862 | + 0.78 | ... | + 3.00 | + 6.27 | − 3.27 | − 3.3 | − 1.814 | − 0.5 | − 0.10 | ......... | ...... | + 1.25 |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—APRIL, 1862.

(NINE MILES WEST OF MONTREAL.)

## BY CHARLES SMALLWOOD, M.D., LL.D.

*Latitude—45 deg. 32 min. North. Longitude—73 deg. 36 min. West. Height above the Level of the Sea—118 feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. t'nths | Rain in inches. | Snow in inches. | Weather, &c. A Cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | | | | | 6 A. M. | 2 P. M. | 10 P. M. |
| 1 | 30.149 | 30.179 | 30.254 | 36.2 | 43.9 | 34.1 | .177 | .218 | .155 | .85 | .76 | .79 | E S E | S S E | S S W | 0.30 | 1.5 | ... | ... | Cirr. Str. 4. | Cu. Str. 10. | Cu.Str. 9.h.&r. |
| 2 | 290 | 114 | 29.927 | 32.1 | 51.4 | 33.1 | 143 | 295 | 165 | 79 | 78 | 89 | S S E | S S E | S b W | 118.10 | 3 0 | Inap. | ... | Fog. | Do. 4. | Clear [7.10pm |
| 3 | 29.779 | 29.894 | 90 | 40.1 | 47.2 | 35.8 | 203 | 298 | 177 | 82 | 92 | 84 | W S W | W S W | W | 409.90 | 2.5 | 0.014 | ... | Cirr. Str. 10. | Rain. | Rain. |
| 4 | 30.210 | 30.158 | 30 251 | 22.0 | 42.2 | 27.0 | 084 | 177 | 111 | 71 | 66 | 75 | W | S b W | S W | 233.60 | 1.0 | ... | ... | Clear. | Clear. | Clear. Z. l't br't |
| 5 | 109 | 29.779 | 29.770 | 17.1 | 29.2 | 27.4 | 063 | 142 | 129 | 67 | 88 | 88 | N E b E | S S E | W S W | 255.60 | 2.5 | ... | 3.70 | Clear. | Snow. | Cu. Str. 10. |
| 6 | 29.861 | 897 | 30.104 | 30.1 | 34.6 | 26.2 | 130 | 126 | 111 | 78 | 65 | 81 | S S W | W b N | W N W | 122 70 | 1.5 | ... | ... | C. C. Str. 8. | Clear. | C. Cum. 4 |
| 7 | 30.228 | 30.221 | 235 | 11.6 | 36.4 | 15.4 | 051 | 149 | 055 | 72 | 71 | 64 | W S W | W S W | S S E | 214.80 | 0.5 | ... | ... | Clear. | Do. | Clear. |
| 8 | 196 | 144 | 135 | 5.1 | 44.3 | 16.7 | 041 | 195 | 053 | 74 | 68 | 75 | N E | E | S S W | 42.20 | 0.5 | ... | ... | Do. | Cirr. Cum. 4. | Do. |
| 9 | 103 | 009 | 101 | 10.4 | 41.1 | 24.3 | 054 | 190 | 09 | 78 | 74 | 73 | E | N N E | N N E | 105.90 | 1.5 | ... | ... | Clear. | Clear. | Do. |
| 10 | 145 | 345 | 277 | 14.7 | 52.4 | 36.7 | 042 | 282 | 184 | 62 | 73 | 85 | N E b E | S E b E | S E | 172.00 | 1.5 | ... | ... | Do. | Do. Inp. S. H. | C. C. Str. 6. |
| 11 | 319 | 400 | 407 | 22.5 | 54.0 | 31.0 | 095 | 308 | 126 | 78 | 74 | 76 | N E b E | S E b E | S E b E | 85.50 | 0.8 | ... | ... | Do. | Do. [9.30 | Clear. |
| 12 | 379 | 367 | 34 | 26.2 | 56.0 | 35.2 | 111 | 342 | 177 | 81 | 78 | 85 | N E | S W | S b W | 118.40 | 0.5 | ... | ... | Do. | Do. | Do. |
| 13 | 250 | 241 | 227 | 30.9 | 56.3 | 35.6 | 134 | 315 | 177 | 82 | 71 | 85 | N E b E | S S E | S S E | 0.20 | 0.5 | ... | ... | Do. | Do. | Do. |
| 14 | 201 | 199 | 241 | 24.1 | 57.4 | 38.9 | 100 | 381 | 188 | 79 | 81 | 87 | N E b E | S E | S E b E | 2.00 | 1.0 | ... | ... | Do. | Cu. Str. 4. | C. C. Str. 8. |
| 15 | 398 | 524 | 351 | 37.2 | 51.7 | 39.9 | 199 | 296 | 210 | 90 | 79 | 86 | S S E | S E | S E b E | 1.10 | 1.0 | Inap. | ... | Slight Rain. | C. C. Str. 4. | Clear. Ft.A.B. |
| 16 | 279 | 183 | 11 | 36.5 | 61.2 | 44.2 | 191 | 442 | 265 | 90 | 83 | 92 | E b S | S E b E | E S E | 5.11 | 1.5 | ... | ... | Clear. | Cirr. 4 | Cu. Str. 10. |
| 17 | 001 | 048 | 29.998 | 48.6 | 66.4 | 48.1 | 303 | 502 | 310 | 89 | 78 | 92 | E S E | S S W | S b W | 56.90 | 0.5 | ... | ... | C. C. Str. 6. | Do. 4. | Cirr. 2. Zod. lt. |
| 18 | 29.997 | 29.883 | 75 | 40.5 | 66.1 | 42.0 | 219 | 219 | 244 | 88 | 87 | 91 | W b N | W b N | S W b S | 30.80 | 1.5 | 0.161 | ... | Fog. | C. C. Str. 4. | Rain. |
| 19 | 824 | 951 | 30.002 | 41.1 | 46.1 | 39 9 | 212 | 258 | 210 | 82 | 81 | 8 | W | W | W | 344.50 | 2.0 | ... | ... | C. Cum. 6. | Cu. Str. 8. | Cu. Str. 10. |
| 20 | 30.007 | 30.075 | 151 | 38.4 | 50.0 | 39.7 | 186 | 290 | 193 | 81 | 82 | 82 | W b S | S W | S b W | 66.30 | 0.5 | ... | ... | Clear. | Clear. | Clear. Z. l't br't |
| 21 | 097 | 29.924 | 29.96 | 34.1 | 52.9 | 41.2 | 162 | 308 | 235 | 84 | 79 | 9 | E S E | S E | S E | 45.20 | 0.5 | ... | ... | Do. | Cu. Str. 10. | Rain. |
| 22 | 29.698 | 498 | 45 | 38.0 | 49.9 | 44.6 | 214 | 297 | 282 | 95 | 92 | 96 | N N E | N E b E | S E | 139.20 | 2.5 | 0.220 | ... | Cu. Str. 10. | C. C. Str. 10. | Cu Str. 10. |
| 23 | 464 | 620 | 82 | 40.1 | 43.1 | 29.0 | 210 | 222 | 129 | 86 | 83 | 84 | W S W | S W | W b N | 317.00 | 1.0 | ... | ... | Do 8. | C. Cirr. 4. | C. C. Str. 8. |
| 24 | 861 | 937 | 30.042 | 26.1 | 32.3 | 32.0 | 111 | 143 | 149 | 81 | 79 | 84 | N W | W S W | W b N | 456.80 | 0.5 | ... | ... | Do. 4. | Cu. Str. 10. | Clear. |
| 25 | 30.164 | 30.130 | 18 | 24.7 | 50.1 | 33.6 | 105 | 290 | 143 | 81 | 80 | 84 | W N W | S S W | S S W | 122.90 | 1.0 | ... | ... | Clear. | Clear. | Do. |
| 26 | 340 | 323 | 36 | 31.1 | 57.6 | 39.9 | 158 | 372 | 19 | 89 | 78 | 82 | N E b E | E S E | S E b E | 32.90 | 1.5 | ... | ... | C. Cu. 4. | Do. | Do. |
| 27 | 391 | 301 | 26 | 32.1 | 62.7 | 42.1 | 149 | 422 | 24 | 84 | 75 | 91 | N E b E | N E b E | N E b E | 16.80 | 1.0 | ... | ... | Clear. | C. C. Str. 4. | Cu. Str. 10. |
| 28 | 101 | 050 | 06 | 44.6 | 45.9 | 43.6 | 282 | 275 | 271 | 95 | 92 | 96 | E S E | S S E | E N E | 112.90 | 2.5 | Inap. | ... | Rain. | Cu. Str. 10. | Rain. |
| 29 | 070 | 020 | 02 | 40.1 | 59.2 | 40.1 | 225 | 380 | 216 | 92 | 76 | 86 | E S E | S b E | S W | 53.70 | 2.0 | ... | ... | Cu. Str. 10. | Do. 4. | Clear. Ft.A.B. |
| 30 | 098 | 021 | 11 | 42.1 | 65.2 | 47.0 | 228 | 490 | 30 | 87 | 81 | 95 | S | S W b S | S E | 75.90 | 1.0 | ... | ... | C. C. Str. 4. | Clear. | Do. |
| ... | ...... | ...... | ...... | ... .. | ...... | .. ... | ... | ... | ... | ... | ... | ... | ...... | ...... | ...... | ...... | .... | ... | ... | ........ | ........ | ........ |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—MAY, 1862.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D., LL.D.

*Latitude*—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. (tenths) | Rain in Inches. | Snow in Inches. | WEATHER, &c. A cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | | | | | 6 A.M. | 2 P.M. | 10 P.M. |
| 1 | 30.061 | 30.127 | 30.091 | 42.6 | 50.0 | 43.7 | .237 | .302 | .248 | 57 | .82 | .88 | N E b E | N E b E | N E b E | 107.60 | 2.0 | 0.133 | ... | C. C. Str. 4. | Rain. | Rain. |
| 2 | 29.954 | 29.821 | 29.818 | 40.4 | 49.1 | 45.3 | .225 | .322 | .300 | 90 | .92 | 1.00 | N E b E | N E b E | N E b E | 185.90 | 5.0 | 1.576 | ... | Rain. | Do. | Do. |
| 3 | 819 | 829 | 845 | 44.2 | 64.2 | 52.1 | .248 | .454 | .331 | 95 | .77 | .86 | S S E | S W | S E | 89.90 | 3.0 | In'p. | ... | Cu. Str. 10. | C. C. Str. 8. | C. C. Str. 4. |
| 4 | 795 | 733 | 772 | 46.2 | 56.8 | 46.7 | .262 | .385 | .280 | .84 | .84 | .88 | S W | S W | S S W | 147.50 | 1.0 | ... | ... | C. C. Str. 4. | Cu. Str. 8. | Cu. Str. 2. |
| 5 | 694 | 701 | 785 | 42.1 | 58.4 | 50.2 | .244 | .245 | .303 | .91 | .91 | .85 | S b W | S W | S W | 125.80 | 1.0 | In'p. | ... | Rain. | Do. 4. | C. C. Str. 4. |
| 6 | 600 | 343 | 451 | 39.7 | 61.0 | 46.5 | .210 | .436 | .262 | .86 | 80 | .84 | W | W | N b W | 196.00 | 2.0 | ... | ... | Clear. | C. C. Str. 4. | Clear. Ft.A.B. |
| 7 | 487 | 550 | 672 | 31.1 | 40.0 | 39.1 | .155 | .235 | .195 | .89 | .91 | .82 | N E b E | N N E | N N W | 112.30 | 4.0 | ... | 2.91 | Snow. | Thaw. | Cu. Str. 6. |
| 8 | 770 | 774 | 680 | 36.1 | 55.7 | 51.1 | .177 | .370 | .315 | .85 | .84 | .89 | N N E | N N E | S b E | 102.80 | 2.0 | ... | ... | Cu. Str. 10. | Cirr. 4. | Clear. |
| 9 | 601 | 394 | 807 | 46.3 | 67.1 | 56.9 | .269 | .556 | .370 | 88 | .81 | .84 | W S W | S S W | W | 241.40 | 1.5 | ... | ... | Do. 10. dis.th. | C. Cirr. 4. | C. C. Str. 4. |
| 10 | 434 | 549 | 751 | 49.7 | 56.2 | 43.0 | .299 | .288 | .20 | .82 | .65 | .75 | N N W | S b W | N W | 347.40 | 1.5 | ... | ... | Clear. | Cu. Str. 8. | Clear. |
| 11 | 885 | 885 | 972 | 34.1 | 66.4 | 48.2 | .156 | .438 | .242 | .80 | 68 | .74 | W b N | N b W | S S W | 207.70 | 1.5 | ... | ... | Do. | Clear. | Cu. Str. 4 |
| 12 | 884 | 710 | 712 | 46.4 | 73.6 | 59.8 | .262 | .351 | .49 | .84 | .44 | .79 | S S W | N N E | S W | 165.10 | 2.0 | ... | ... | Cu. Str. 10. | Hazy. | Hazy. |
| 13 | 752 | 744 | 836 | 46.4 | 60.1 | 47.0 | .232 | .374 | .25 | .84 | .73 | 81 | S W | S b W | S b W | 69.50 | 2.0 | In'p. | ... | Do. 10. | Clear. | Clear. |
| 14 | 834 | 862 | 876 | 47.4 | 60.1 | 57.0 | .232 | .262 | 378 | 73 | .51 | .81 | N E | E S E | S S E | 53.60 | 1.5 | ... | ... | Clear. | Do. | Cu. Str. 4. |
| 15 | 918 | 850 | 903 | 51.1 | 84.3 | 64.0 | .296 | .925 | .471 | .80 | .79 | .81 | S | S | S | 71.60 | 1.0 | ... | ... | Do. | Do. | Do. Met. in S. |
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| 21 | 30.001 | 916 | 740 | 44.7 | 60.5 | 84.2 | .202 | .338 | .362 | 71 | .65 | .87 | S S E | S E | E | 118.90 | 3.5 | 0.680 | ... | C. C. Str. 6. | Rain. | Cu. Str. 10. |
| 22 | 29.628 | 782 | 780 | 41.1 | 58.4 | 52.1 | .235 | .358 | .33 | .91 | .73 | .86 | S S W | S S W | W S W | 376.90 | 3.0 | 0.336 | ... | C. C. Str. 10. | Cu. Str. 10. | Clear. |
| 23 | 601 | 748 | 899 | 56.1 | 62.9 | 47.0 | .391 | .363 | .21 | .87 | .64 | .77 | W S W | W N W | N b W | 130.11 | 1.5 | In'p. | ... | Cu. Str. 10 | Clear. | Do, |
| 24 | 980 | 876 | 899 | 38.2 | 55.9 | 58.3 | .165 | .288 | .334 | 72 | .65 | .82 | N W b W | W | S | 162.20 | 1 5 | ... | ... | Clear Frost. | Str. 4. | Do. |
| 25 | 856 | 827 | 816 | 47.2 | 65.0 | 54.0 | .197 | .427 | .315 | 78 | .71 | .83 | S b W | W b S | W S W | 152.00 | 1.5 | ... | ... | Do. | Cu Cir. 4. | C. C. Str. 4. |
| 26 | 866 | 840 | 747 | 47.0 | 67.1 | 55.3 | .256 | .425 | .32 | 81 | .64 | .77 | N E b E | S S W | N E b E | 162.40 | 1 5 | ... | ... | C. C. Str. 6. | C. C. Str. 4 | Cu. Str. 10. |
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| 28 | 630 | 605 | 617 | 54.2 | 61.3 | 48.8 | .332 | .383 | .229 | 87 | .71 | .69 | S S E | S W | W S W | 298.20 | 1.0 | ... | ... | C. C. Str. 10 | Cu Str. 4. | Clear. |
| 29 | 660 | 689 | 714 | 44.4 | 67.2 | 55.3 | .215 | .425 | .321 | .79 | .64 | .74 | W N W | W b N | W b N | 243.30 | 1.0 | ... | ... | Clear. | Clear. | Do. |
| 30 | 451 | 580 | 751 | 39.1 | 70.4 | 59.2 | .180 | .449 | .30 | 77 | .61 | .85 | S S E | S S E | S S E | 0.30 | 1.0 | ... | ... | Do. | Do. | Do. Au. Bor. |
| 31 | 702 | 667 | 704 | 46.0 | 77.9 | 57.9 | .238 | .658 | .372 | .77 | .67 | .78 | E S E | S S W | S S E | 0.00 | 1.5 | ... | ... | Do. | Do. | Do. |

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR APRIL, 1862.

| | | |
|---|---|---|
| Barometer | Highest, the 11th day | 30.407 |
| | Lowest, the 23rd day | 29 464 |
| | Monthly Mean | 30.074 |
| | Monthly Range | 0.943 |
| Thermometer | Highest, the 17th day | 66°.4 |
| | Lowest, the 8th day | 5°.1 |
| | Monthly Mean | 39.°06 |
| | Monthly Range | 61°.3 |
| Greatest intensity of the Sun's Rays | | 82°.2 |
| Lowest Point of Terrestrial Radiation | | −5°.0 |
| Mean of Humidity | | .816 |

Rain fell on 6 days, amounting to 0.395 inches; it was raining 13 hours and 13 minutes.

Snow fell on 1 day, amounting to 3.70 inches; it was snowing 6 hours and 0.5 minutes.

Most prevalent wind, the E. S. E.

Least prevalent wind, the S.

Most windy day, the 24th; mean miles per hour, 19.03.

Least windy day, the 13th; mean miles per hour, 0.00.

Aurora Borealis visible on 2 nights.

Zodiacal light bright and well defined.

The Electrical state of the Atmosphere has indicated very feeble intensity.

*Fringilla Melodia*, Song Sparrow, (*Rossignol*, Fr.) first heard on 6th day.

Swallows, *Hirundo Rufa*, first seen 20th day.

Wild geese, *Anser Canadensis*, first seen flying north 26th day.

Frogs, *Rana fontinalis*, first heard 29th day.

Thermometer in ground 18 inch deep, 44°.

*Errata:* For 1861 in Reports for January and February read 1862.

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR MAY, 1862.

| | | |
|---|---|---|
| Barometer | Highest, the 1st day | 30.129 |
| | Lowest, the 6th day | 29 343 |
| | Monthly Mean | 29.738 |
| | Monthly Range | .786 |
| Thermometer | Highest, the 8th day | 91°0 |
| | Lowest, the 24th day | 28°2 |
| | Monthly Mean | 54°61 |
| | Monthly Range | 62°8 |
| Greatest intensity of the Sun's rays | | 98°2 |
| Lowest point of Terrestrial Radiation | | 24°7 |
| Mean of Humidity | | .786 |
| Amount of evaporation | | 3.61 |

Rain fell on 11 days, amounting to 2.725 inches; it was raining 34 hours and 45 minutes and was accompanied by thunder on 2 days.

Snow fell on 1 day amounting to 2.91 inches; it was snowing 5 hours and 20 minutes.

Most prevalent wind, S.W.

Least prevalent wind, N. by W.

Most windy day, the 19th day; mean miles per hour, 19.97.

Least windy day, the 31st day; Calm.

Aurora Borealis visible on 2 nights.

The Electrical state of the Atmosphere has indicated moderate intensity.

Temperature of the ground 18 inches deep, 61°0.

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THE

# CANADIAN JOURNAL

OF

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SEPTEMBER, 1862.

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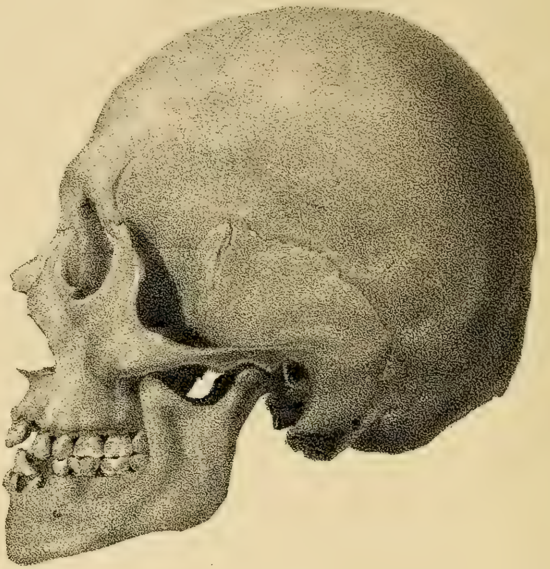

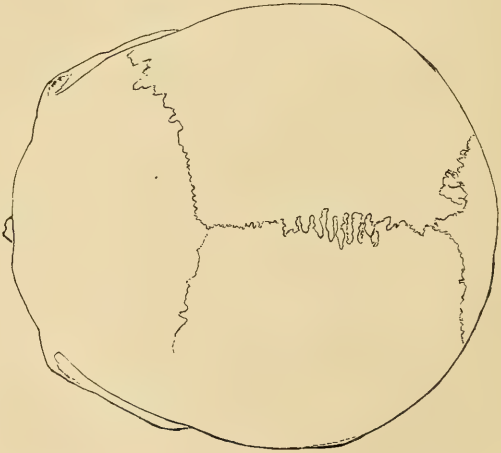

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# THE CANADIAN JOURNAL.

NEW SERIES.

No. XLI.—SEPTEMBER, 1862.

## ETHNICAL FORMS AND UNDESIGNED ARTIFICIAL DISTORTIONS OF THE HUMAN CRANIUM.

BY DANIEL WILSON, LL.D.,
PROFESSOR OF HISTORY AND ENGLISH LITERATURE, UNIVERSITY COLLEGE, TORONTO.

The differences between man and all other animals appear to be so clearly defined, that the Naturalist was long induced to overlook those which distinguish different races of men, and to regard any diversities of structure or relative proportions in the human form as mere variations from one common or ideal type. Nevertheless the craniologist, at the very commencement of his investigations, is led to recognise certain essential varieties of form; though still tempted, like Blumenbach, to refer all these to some "Caucasian" or other assumed highest type. Before, however, the ethnologist directed his attention to such researches, the artist had sought this type in the beautiful realisations of Greek sculpture; and by such means he determined the long-accepted statuary-scale of the human head and figure. The influence of this artistic ideal on the later speculations of the ethnologist should not be overlooked. It guided Camper in assigning the laws of his facial angle; controlled Blumenbach in his determination of the cranial peculiarities of leading races of men; and even influenced Prichard in his definition of the symmetrical or oval form of skull which he ascribed to his first division. Against the ideal canons of an antique statuary scale, however, some of the greatest modern masters protested; foremost of whom was Leonardo da Vinci, of whom Bossi remarks: "He thought but little of any general measure of the species. The true proportion admitted by him, and acknowledged to be of difficult investigation, is solely the proportion of an individual in regard to himself, which, according to true imitation, should be different in all the individuals of a species, as is the case in nature." In the features of the face there are the endless varieties of portraiture, controlled by family and national affinities, and so also in the varying proportions of the skull there appears to be an approximation in each race towards a special form. The craniologist accordingly finds in nature his short and truncated; his long and tapering, or "boat-shaped;" his high or pyramidal; his broad, flattened, and oval: as well as intermediate forms. But besides those, to each of which a distinctive name has been assigned, attention is being anew directed to a totally distinct class, in which not only the absence of symmetry is suggestive of abnormal structure; but wherein certain special forms are recognised as the result of artificial causes, operating accidentally or by design. Some of these artificial forms have an additional significance from the fact that they are peculiar to man, and originate in causes which distinguish him from all inferior orders of animated nature. This is specially the case with one of the classes of artificial conformation, already traced, in a former number of this Journal, to influences resulting from the mode of nurture in infancy. As the same opinion has been recently reproduced in an English scientific journal as a novel discovery,* a recapitulation of the original idea, with additional illustrations, may not be out of place here.

In the month of March, 1855, an Indian cemetery was accidentally opened at Barrie, on Lake Simcoe, from which upwards of two hundred skulls are said to have been exhumed, along with bones and Indian relics. Among the Crania preserved in the collection of the Canadian Institute is one of those Indian skulls, selected, no doubt, owing to its unusual form, which could scarcely fail to attract attention. It was found in the country of the ancient Hurons; and though the idea was, that it lay among other relics of a battle-field,—to which its unusual shape would give countenance, as the indication of some foreign intruder,—yet it is possible that it had been deposited in one of the Ossuaries into which it was the custom of the Huron Indians to gather their scaffolded dead, after they had been exposed for a certain time to decay.

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* *Nat. Hist. Review*, July, 1862. J. B. Davis, M.R.C.S. Eng., &c., *On Distortions in the Crania of the Ancient Britons.*

The skull in question is large and massive, and differs essentially from the Huron type of Cranium in its short longitudinal diameter, vertical occiput, and flattening of the whole parieto-occipital region to so marked a degree, that when laid on the occiput it rests as firmly as on the base.

I have already shown, in a former paper,* that the Hurons were characterized by the more elongated, or dolichocephalic form of head. In this respect indeed their crania are prominently distinguished, exhibiting a greater divergence from Dr. Morton's assumed type, than any other of the American Aborigines, if we except the Esquimaux. The Barrie skull, on the contrary, approximates in a considerable degree to the celebrated mound-skull of the Scioto Valley, which Dr. Morton specially selected as "perhaps the most admirably formed head of the American race hitherto discovered. It possesses," he added, "the national characteristics in perfection, as seen in the elevated vertex, flattened occiput, great interparietal diameter, ponderous bony structure, salient nose, large jaws, and broad face. It is the perfect type of Indian conformation, to which the skulls of all the tribes from Cape Horn to Canada more or less approximate."

I formerly showed, from the results of a series of careful measurements of Canadian crania, that the latter remark is not born out by a minute determination of the Algonquin, Iroquois, or Huron cranial type; and more extensive observations have since strongly confirmed me in that conclusion. The mean derived from the measurement of thirty-seven skulls procured from Indian graves within the Huron district, including those of twenty-nine males and eight females, is here placed in comparison with the measurements of the Scioto-Mound and Barrie skulls; and, as will be perceived, presents a striking contrast:—

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* Supposed prevalence of one Cranial type throughout the American Aborigines. *Canadian Journal*, Vol. II., p. 406.

| | L. D. | P. D. | F. D. | V. D. | I. A. | I. L. | O. F. A. | H. O. |
|---|---|---|---|---|---|---|---|---|
| Scioto Mound Skull.. | 6.50 | 6.00 | 4.50 | 6.20 | 16.00 | 4.50 | 13.80 | 19.80 |
| Barrie Skull....... | 6.60 | 6.40 | 5.20 | 5.30 | 16.00 | 4.60 | 14.40 | 20.70 |
| Huron Mean....... | 7.40 | 5.43 | 4.35 | 5.43 | 14.66 | 4.23 | 14.65 | 20.48 |

If no artificial element was supposed to affect any of those forms, the Barrie skull would naturally be classed with the former in any such comparison; and even with a full recognition of the artificial influences, for the illustration of which the Barrie skull (Plate I.) is now selected, it forms quite an exceptional instance among crania exhumed within the Huron country. Its markedly brachycephalic character, however, is chiefly determined by its parieto-occipital flattening, with the accompanying parietal expansion; and although the same may be affirmed to some extent of the typical Mound-skull, yet it is only in certain respects that the two agree in form or measurements. The important difference in the vertical diameters constitutes an essential distinction between them, the Barrie skull being below the Huron mean, while the Mound-skull is considerably above it. Dr. Morton was familiar with the effects produced by the widely extended practise among the American Aborigines of cranial deformation, and did not overlook its probable influence on certain familiar forms of head, which he assumed to be universally prevalent throughout the Western Hemisphere. Accordingly, while selecting the Scioto Mound-skull as most perfectly illustrating the typical American head, he remarks on its peculiar parieto-occipital conformation:—"Similar forms are common in the Peruvian tombs, and have the occiput, as in this instance, so flattened and vertical, as to give the idea of artificial compression; yet this is only an exaggeration of the natural form, caused by the pressure of the cradle-board in common use among the American nation."

But the vertical flattened occiput, thus referred to as of common occurrence in Peruvian crania, and described as, in its extremest development, only an exaggeration of the American typical form, is by no means peculiar to the New World; and a comparison of the American examples now referred to, with others derived from ancient British cemeteries, may help to throw new and interesting light on some of the customs of Europe's prehistoric tribes. The subject thus referred to was first brought by me, under the notice of ethnologists, in a paper on the supposed American cranial type, read before the American Association for the Advancement of Science, at its Montreal meeting in August, 1857,* and submitted to the notice of the Ethnological section of the British Association, at the Dublin meeting in the same year.† In this I selected the Barrie skull as exhibiting in a remarkable manner the peculiarities of the vertical occiput; and after quoting the above remarks of Dr. Morton on the corresponding feature, as it occurs both in the Scioto Mound-skull, and in many Peruvian crania, the paper thus proceeds:—

> I think it extremely probable that further investigation will tend to the conclusion that the vertical or flattened occiput, instead of being a typical characteristic, pertains entirely to the class of artificial modifications of the natural cranium familiar to the American ethnologist alike in the disclosures of ancient graves, and in the customs of widely separated living tribes. In this I am further confirmed by the remark of Dr. Morton in reference to the Peruvian crania:—"These heads are remarkable, not only for their smallness, but also for their irregularity; for in the whole series in my possession there is but one that can be called symmetrical. This irregularity chiefly consists in the greater projection of the occiput to one side than the other, showing in some instances a surprising degree of deformity. As this condition is as often observed on one side as the other, it is not to be attributed to the intentional application of mechanical force; on the contrary, it is to a certain degree common to the whole American race, and is sometimes, no doubt, increased by the manner in which the child is placed in the cradle."‡ To this Dr. Morton subsequently added in describing an unsymmetrical Mexican skull: "I had almost omitted the remark, that this irregularity of form is common in, and *peculiar to, American crania*."§ The latter remark, however, is too wide a generalization. I have repeatedly noted the like unsymmetrical characteristics in the brachycephalic crania of the Scottish barrows; and it has occurred to my mind, on more than one occasion, whether such may not furnish an indication of some partial compression, dependent, it may be, on the mode of nurture in infancy, having tended, in their case also, if not to produce, to exaggerate the short longitudinal diameter, which constitutes one of their most remarkable characteristics.

From this it will be seen that, so early as 1857, I had given expression to an idea formed previously to my leaving Scotland in 1853, relative to undesigned artificial changes wrought on crania recovered from Scottish barrows, and which I conceived to be traceable to the mode of nurture in infancy. That event mainly prevented the publication of the views I had formed on this subject, earlier as well as in a more ample form, from the consequent interruption of researches then in progress, relative to the physical conformation of early British races. The delay, however, has furnished me with novel illustrations on this and other points relating to physical ethnology, derived from corresponding phenomena in the crania of the New World.

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* *Canadian Journal*, Vol. II., p. 406.

† *Edinburgh Philosoph. Journal*, N. S., Vol. VII., p. 1.

‡ Crania Americana, p. 115.

§ Types of Mankind, p. 144.

So remarkable a change has taken place during the interval, that it is now difficult to realize such a condition of things as prevailed when Sir Richard Colt Hoare, one of the most intelligent and zealous of British antiquaries, explored the sepulchral mounds of Wiltshire, and recovered from them a host of illustrations of primitive arts and customs, but systematically rejected evidence of the physical characteristics of the artists by whose skill such objects had been wrought. Nothing could more strikingly illustrate this than the contrast presented between the "*Ancient Wiltshire*," otherwise so rich in its stores of archæological information; and the "*Ten Years' Diggings in Celtic and Saxon Grave Hills*," which records the results of researches closely analogous to those of Sir R. C. Hoare, carried on by the late Mr. Thomas Bateman, in coöperation with two zealous fellow-labourers, in Derby, Stafford, and York-shires, from 1848 to 1858. The Wiltshire Antiquary, with commendable reverence, restored the bones to the ravished sepulchre, from whence it never occurred to him that they would be again recovered, as furnishing evidence of greater significance to the scientific student than the pottery and implements which he preserved. Under the influence of the change in the appreciation of such evidence, his Derbyshire follower claims a special value for information derived by him from the systematic opening of upwards of four hundred tumuli, because it embodies the results of his exhumation of such a collection of ancient crania as no future writer is likely to have access to.

The result of my own examination of such ancient Scottish crania as were accessible at the period when my researches were interrupted, along with imperfect references to other explorations and disclosures, was to impress me with the conviction that the evidence pointed to the existence of more than one early race, and that traces seemed to be recognizable, suggestive of one characterised by great length and narrowness of head, a remarkable prolongation of the occiput, and poor frontal development. To this another appeared to have succeeded with a short or brachycephalic head, prominent parietal development, and truncated occiput. Accordingly when the questions involved in such researches and speculations were brought under the notice of ethnologists in a paper read by me before the British Association in 1850, I there remarked: "Not the least interesting of the indications which this course of investigation seems to establish in relation to the primitive races of Scotland, are the evidences of the existence of primitive British races prior to the Celtæ; and also the probability of these races having succeeded each other in a different order from the primitive colonists of the north of Europe. Meanwhile, however, these data, and the conclusions derived from them, are produced chiefly with a view to induce more extended research. A much greater accumulation of evidence is requisite to establish any absolute or certain conclusions; and this can only be obtained by a general interest in the inquiry leading to the observation of such, where the researches of the archæologist, or the chance operations of the agriculturist afford the desired means."* To suggest the possibility of primitive races of men, not of Celtic origin, having been the earlier occupants of Scotland appeared, in 1850, a sufficiently daring extravagance. But the *Antiquités Celtiques et Antédiluviennes* of M. Boucher de Perthes, had just issued from the French press; and already, after so brief an interval, we read in familiar phraseology of the prehistoric man of the Pfahlbauten of Switzerland and France, or of the Crannoges of Ireland and Scotland, and the Kjokkenmöddings of Denmark; and are no longer startled even to hear of the Flint-Folk of the preglacial period, the contemporaries of the *Elephas primigenius* and the *Rhinoceros tichorinus*. In 1851, before this wonderful revolution in opinion had been brought about, my ideas on the prehistoric races of Scotland, and inferentially of Britain, were set forth in greater detail;† but still necessarily accompanied with expressions of regret at the inadequate data available for investigations on a subject then altogether novel. Scottish antiquaries—sympathising in the views which guided Sir R. C. Hoare in returning to the barrow the skull and bones of its occupant, while carefully preserving the implements and personal ornaments originally deposited beside them,—had for the most part transferred to the Phrenological Museum the few earlier crania recovered from Scottish barrows. To these phrenological zeal had made some additions; and my own researches enabled me to increase the number. But after setting forth the measurements and most noticeable characteristics of thirty-nine skulls, including some from medieval cemeteries, I was careful to express the conviction that such limited data could, at most, only suffice for the basis of suggestive hypotheses.

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* *Inquiry into the Evidence of Primitive Races in Scotland prior to the Celtæ.* Report fBrit. Assoc. 1850, p. 144.

† *Archæology and Prehistoric Annals of Scotland.*

The facilities derived from repeated study of the remarkable collection of Crania of the Academy of Sciences of Philadelphia, as well as those in other American museums, have since familiarized me with the varied forms of which the human head is susceptible, under the influence of artificial compression; and while the examination and measurement of some hundred specimens of American crania have satisfied me of the existence of dolichocephalic and brachycephalic heads as tribal or national characteristics of the New World; I have also been no less struck with the exaggerated brachycephalic form, accompanied with the parieto-occipital flattening, or the vertical occiput, the effects, as it appears to me, of undesigned artificial deformation, resulting from the process of nursing still practised among certain Indian tribes. Of this peculiar brachycephalic form the Barrie skull, figured on plate I., is a highly characteristic illustration. Found in an Indian cemetery, on a continent where the craniologist is familiar with examples of the human head flattened and contorted into the extremest abnormal shapes; and where the influence of the Indian cradle-board in producing or increasing the flattened occiput had long since been pointed out by Dr. Morton: the peculiar contour of the Barrie skull excited no more notice than pertained to the recognition of one well-known variety of American cranial forms. But when almost precisely the same form is found in British graves, it is suggestive of ancient customs hitherto undreamt of, on which the familiar source of corresponding American examples is calculated to throw a novel light.

About the year 1852, some labourers engaged in levelling a sepulchral mound in the Parish of Codford, South Wiltshire,—the scene of Sir R. C. Hoare's valuable explorations,—recovered from it a skull which has been preserved by Mr. J. Y. Ackerman, and described in the "*Crania Britannica*." This is the skull represented on plate

II., selected here from those of its class in the *Crania Britannica* for the purpose of comparison with the Barrie Indian skull. As seen in profile the vertical occiput is still more remarkable, and materially contributes to determine the peculiar characteristics which attracted the attention of Mr. J. Barnard Davis, by whom it is described. He remarks of it: "Its most interesting peculiarities are its small size, and its decidedly brachy-cephalic conformation. This latter character, which commonly appertains to the ancient British cranium, and even to that form which we regard as typical, is seldom met with in so marked a manner." He then describes the fore-part of the head, with its oblique forehead, pointed chin, and quadrangular orbits, producing the aspect of a face "eminently British," and thus proceeds: "The zygomatic arches are short, a character which appertains to the entire calvarium, but is most concentrated in the parietals, to which the abruptly ascending portion of the occipital lends its influence. The widest part of the calvarium is about an inch behind, and as much above the auditory foramen, and when we view it in front we perceive it gradually to expand from the outer angular process of the frontal to the point now indicated. The dome of the brain-case is remarkably equable, and is uninterrupted by any irregularity. The vault of the palate is small and short, but lofty. We believe we have thus described every noteworthy characteristic that can assist the eye in realizing the original from the study of the figures now presented." Mr. Davis accordingly proceeds to point out the exceptional character of the Codford cranium, owing to its decidedly brachycephalic form, but without indicating the special peculiarity of the flattened occiput, or referring any of its features to artificial causes. On the contrary, he concludes with the remark: "It shows the latitude of form, or variety, among any given set of features; but still far from allowing of the withdrawal of the skull from the race to which it belongs, and without by any means wholly overshadowing the ethnical characters appertaining to that race."* These opinions Mr. Davis appears to have retained down to the year 1857, when I suggested the probable artificial source of the flattened occiput; and, indeed, to have abandoned any recognition of exceptional features in the Codford Cranium: as in a paper communicated by him to the Academy of Natural Sciences of Philadelphia that same year, this skull is specially selected as one of three representatives of "the typical form of cranium of the ancient Briton," in contrast to others which he calls "aberrant forms."*

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* *Crania Britannica.* Decade II. Pl. 14.

None of all the skulls figured in profile in the first four decades of the *Crania Britannica*, exhibits the parieto-occipital flattening, with its exaggerated brachycephalic accompaniments, so markedly as this one recovered from the Codford Barrow, and shown here on Plate II. Nevertheless it is obvious that it had not occurred to the learned craniologist, when describing, as he says, every noteworthy characteristic, to ascribe any of the features of this peculiar type of cranium to artificial causes, though he has now adopted the opinion that some of the British crania may owe in part their brachycephalic proportions, with the accompanying unsymmetrical development and vertical occiput, to some partial compression dependent on the mode of nurture in infancy. The first example of this peculiar occipital conformation which attracted my attention, as possibly traceable to other than mere ethnical specialities, or natural variations from a normal typical form, occurred in a skull recovered from a cist opened at Juniper Green, in the vicinity of Edinburgh, on the 17th of May, 1851. Soon after the publication of the *Prehistoric Annals of Scotland*, when my attention was specially directed to this subject, I learned of the accidental discovery of a stone cist in a garden on the Lanark road, a few miles to the north-west of Edinburgh, and immediately proceeded to the spot. The cist occupied a slightly elevated site, distant only a few yards from the road; and as this had been long under cultivation as a garden, if any mound originally marked the spot, it had disappeared, and no external indication distinguished it as a place of sepulture. A shallow cist formed of unhewn slabs of sandstone enclosed a space measuring 3 feet 11 inches in length, by 2 feet 1 inch in breadth at head, and 1 foot 11 inches at foot. The joints fitted to each other with sufficient regularity to admit of their being closed by a few stone chips inserted at the junction, after which they appeared to have been carefully cemented with wet loam or clay. The slab which covered the whole projected over the sides, so as effectually to protect the sepulchral chamber from any infiltration of earth. It lay in a sandy soil, within little more than two feet of the surface; but it had probably been covered until a comparatively recent period by a greater depth of soil, as its site was a little higher than the sur-

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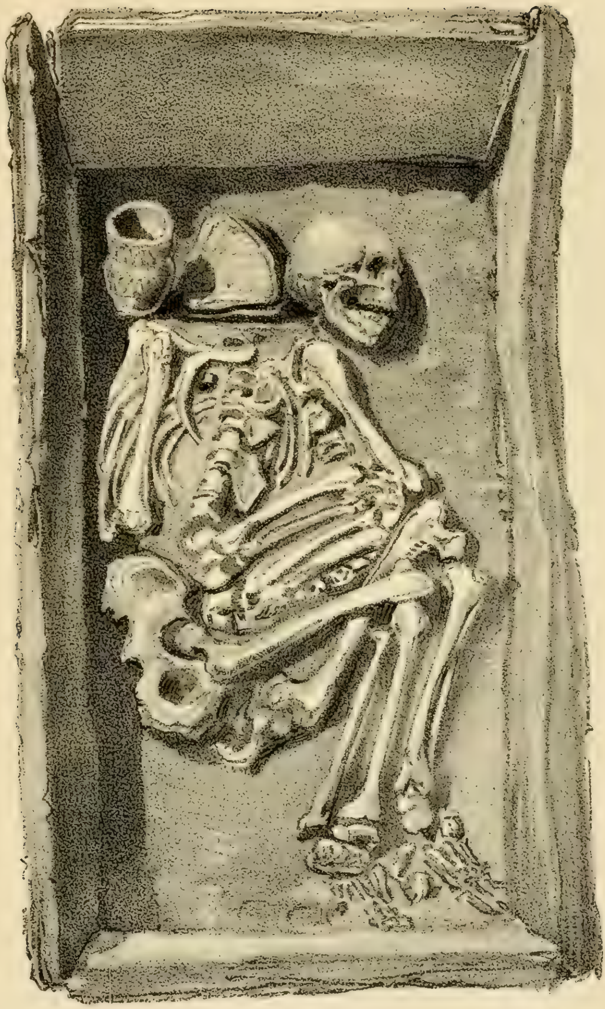
* Proceedings of Acad. Nat. Sciences, Philadelphia. 1857, p. 42.



rounding surface, and possibly thus marked the traces of the nearly levelled tumulus. Slight as this elevation was, it had proved sufficient to prevent the lodgment of water, and hence the cist was found perfectly free from damp. Within this a male skeleton lay on its left side. The arms appeared to have been folded over the breast, and the knees drawn up so as to touch the elbows. The head had been supported by a flat waterworn stone for its pillow; but from this it had fallen to the bottom of the cist, on its becoming detached by the decomposition of the fleshly ligatures; and, as is common in crania discovered under similar circumstances, it had completely decayed at the part in contact with the ground. A portion of the left side is thus wanting; but with this exception the skull was not only nearly perfect when found, but the bones are solid and heavy; and the whole skeleton appeared to me so well preserved as to have admitted of articulation. From the view of the skull engraved in the *Crania Britannica*, it appears to have been somewhat mutilated since I last examined it. Alongside of the head of the deceased, above the right shoulder, a neat earthen vase had been placed, probably with food or drink. It contained only a little sand and black dust when recovered, uninjured, from the spot where it had been deposited by affectionate hands long centuries before, and is now preserved along with the skull in the Scottish Museum.

Notwithstanding the hundreds of barrows that have been opened, it is rare indeed to witness an example of the skeleton *in situ*, so entirely undisturbed as this was. Even where the cist has only been invaded by a partial infiltration of earth or sand, its removal necessitates the displacement of the bones; and when the skeleton has to be exhumed, as is more frequently the case, from the incovering soil, any attempt to represent its actual position must depend to a great extent on the imagination of the artist. Some of such representations, indeed, partake not a little of fancy sketches. Hence the example here described is peculiarly valuable on account of its faithfully revealing to the eye the undisturbed remains of the ancient North Briton, as they had lain since the fleshly tissues decayed and left the naked skeleton to its long repose. I have accordingly reproduced, on Plate III. a drawing of the Juniper Green cist, from a sketch taken at the time, before a single bone had been displaced. It exhibits the interior of the cist as it appeared on the removal of the covering slab, and suffices to show how far any posthumous compression could affect the form of the skull. The latter is represented in profile, in the *Crania Britannica* (Dec. II. pl. 15.) The sutures are partially effaced by ossification, and other characteristics mark it as that of a man probably upwards of fifty years of age. The teeth also present the familiar characteristic of this ancient class of crania, being worn completely flat, both in the upper and lower jaw, like those of a ruminating animal; indicating the nature of the food as hard grains, nuts, or other substances requiring laborious mastication, different from the mere animal food of a purely hunter state of savage life ; though the same phenomenon is witnessed in a more marked degree among the Walla-walla Indians of the Columbia River. They occupy a barren waste, frequently exposed to drifting sand, and subsist almost entirely on salmon dried in the sun. During the process of desiccation the salmon becomes so impregnated with sand, that it is rare to meet with a Walla-walla much beyond maturity whose teeth are not worn down to the gums by the attrition of his gritty food. Again, among the Peruvians, a similar result is produced, though to a less extent, from their habit of chewing the leaf of the coca mixed with *llute,* a compound made of the wild potatoe, with calcined shells and ashes of alkaline plants.

The Juniper Green Skull, as shown in the full-sized view in the *Crania Britannica,* presents in profile, as well as partially in the vertical view, that square and compact form peculiarly characteristic of the brachycephalic crania of British barrows. But it also discloses, in its flattened occiput, a feature which had escaped my notice in any previous example of primitive Scottish crania; and along with this an unusual parietal breadth increasing towards the occiput, in a manner which I subsequently learned to recognise as an accompaniment of the post-parietal flattening. Only those who have themselves engaged in such researches can fully appreciate the vividness of impressions produced by whatever is characteristic or peculiar in the skull or other relics, handled for the first time as the evidence of the race or age of the freshly opened barrow or cairn, compared with the examination of the same from the shelves of a cabinet. The Juniper Green skull was carried home in my hand, a distance of some miles, and its flattened vertical occiput specially attracted attention, and gave rise to conversation on the way, with my friend Mr. Robert Chambers, who had accompanied me on this excursion.

With the temptation of a novel discovery, I was at first disposed to recognise the traces of art in this abbreviated form of skull, not only as exaggerating the natural characteristics, but as a possible source of their production. But a comparison with examples of the true dolichocephalic form, to which I had already assigned priority in point of time, sufficed to dispel that illusion. At a subsequent meeting of the Society of Antiquaries of Scotland, I accompanied the presentation of the cranium and urn with an account of the circumstances of their discovery, and some remarks on the novel features noticeable in the skull. Unfortunately the printing of the Society's proceedings, which had been suspended for some time, was not resumed till the following season; and no record of this communication was preserved, beyond the title.

The same remarkable parieto-occipital flattening is apparent in another Scottish cranium found, under somewhat similar circumstances, in a cist at Lesmurdie, Banffshire, also engraved in the *Crania Britannica* (Dec. III. 16); and still more so in the one already described, and figured on Plate II., recovered from a Wiltshire barrow. But I was more interested in detecting some slight traces of this artificial parieto-occipital flattening, in a remarkable skull found at Grangemouth, on the Forth, in 1843, at a depth of twenty feet, in a bed of shell and marl. This interesting relic has been engraved on a small scale for a work now in the press;* and, as there shown, is an imperfect calvarium, the basilar and temporal, as well as the facial bones, being absent. But sufficient remains to illustrate its characteristic form, and to show that in its general character it approximates to the brachycephalic crania of British tumuli. It is as symmetrical as the majority of modern heads. A slight depression occurs at the coronal suture; the parietal protuberances are prominent, and the superciliary ridges are well developed. The following measurements of this skull will show that it is of large size, though with a small relative vertical diameter:

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| Longitudinal diameter | 7.43 |
| Parietal diameter | 5.65 |
| Frontal diameter | 4.47 |
| Vertical diameter | 4.75 |
| Occipito-frontal arch | 15.25 |
| Do. from occ. front. protuberance to root of nose | 13.25 |
| Horizontal circumference | 21.13 |

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* *Prehistoric Man: Researches into the Origin of Civilisation in the Old and the New World.* Macmillan & Co.

Attracted as my attention was, to the marked contrast between the protruding occiput of the elongated dolichocephalic, or kumbecephalic skull, recognisable among some Scottish primitive crania that came under my observation, and the abrupt, truncated occiput of the opposite type, I was the more prepared to suspect the exaggeration of the latter peculiar conformation by artificial means; and this has been confirmed as I have become familiar with the characteristic peculiarities of American artificially distorted crania, by recognising in them the constant occurrence of the same unsymmetrical irregularities as are frequent in British brachycephalic crania. The Lesmurdie skull in the Scottish Museum, already referred to, is marked by great inequality in relative lateral development, especially where an unusual post-parietal expansion gives to it its most peculiar character; and the unequal parietal development, or bulging out on the one side, of the Juniper Green skull, is all the more deserving of attention from the precise knowledge we possess of the posthumous influences to which it had been subject. The concomitants of the Lesmurdie skull were little less striking in this respect. It was recovered from a cist formed of slabs of mica-slate. Though constructed with care, and neatly paved with a flooring of water-worn stones embedded in loam, the crevices of the cist had not been so effectually closed as to prevent the micaceous sand and earth from being carried in, so as to fill about three-fourths of the narrow chamber. This accumulation sloped away with diminishing depth towards the northern end, where the skull lay on its left side, so that the earth only partially imbedded it, leaving the right side uncovered. A neatly ornamented urn, as in the Juniper Green cist, stood behind the skull, with its rim protruding above the sand, from which it was recovered in a perfect state. These facts, along with those already detailed in reference to the circumstances under which the Juniper Green skull was found, are important, from the proof they furnish that to whatever cause the unsymmetrical irregularity may be traced, it cannot be ascribed to posthumous compression. The slight accumulation of infiltrated sand in the Lesmurdie cist did not cover the skull; while that at Juniper Green was free even from such trifling adventitious elements. There the skeleton lay within its narrow sepulchral chamber so entirely protected from any external influences, that we fancied we could detect some slight traces of its linen covering, especially on the larger leg bones.

Such examples of markedly unsymmetrical skulls, thus recovered under circumstances which preclude the idea of their irregular conformation being traceable to posthumous sources of change, have an important bearing on the general question of typical and abnormal cranial forms. Mr. J. Barnard Davis appears indeed to have entertertained an opposite view. In describing the Juniper Green skull he remarks: "There is a depression from about the posterior third of the sagittal suture to the tip of the occipital bone; and a want of symmetry in the posterior superior region of the parietals, that on the right side being less prominent than that on the left, —*not improbably a posthumous deformation.*"* So also in his description of the Lesmurdie skull. After defining its peculiar platycephalic form with unusual lateral development in the post-parietal region, Mr. Davis adds: "There is also a want of symmetry in the two sides of this post-parietal swelling. The right side is not equally tumid with the left. Not improbably this irregularity of form, in which this skull agrees closely with that from the Juniper Green cist, *may arise from posthumous distortion.*"† In those remarks the learned craniologist may be presumed to have overlooked circumstances strongly impressed on my own mind, from witnessing the exhumation of the Juniper Green skull, and observing its unsymmetrical conformation and flattened occiput on lifting it from the cist, where it had lain for centuries, unsubjected to the slightest pressure. To whatever cause such irregularity or distortion may be ascribed, its origin must be traced in such examples to some action operating during life. Of the occurrence of posthumous cranial distortion there can be no question. In the remarkable example of an abnormal skull in Dr. Thurnam's collection, recovered from the Anglo-Saxon cemetery at Stowe, in Buckinghamshire, there are indications, especially in the gaping sutures on the base, that it has been subjected to an extraordinary amount of oblique compression, producing changes wholly incompatible with the exercise of important vital functions.‡ The same is no less obvious in the skull recovered from an Indian grave on the site of the ancient Hochelaga, at Montreal, and described by me in a previous number of this Journal.§ The posthumous origin of the distortion is placed beyond doubt in both examples, by the lower jaws having remained unaffected by the pressure that wrought so great a change on the calvaria, thereby supplying an accurate gauge of the amount of distortion, on replacing the condyles in apposition with the glenoid cavities. In the same paper, on "Some modifying elements affecting the ethnic significance of peculiar forms of the human skull," attention is also drawn to the exaggeration of the dolichocephalic type of head, in an Indian skull from an ancient cemetery on the Georgian Bay, now preserved in the Museum of the University of Toronto.

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* *Crania Britannica,* Dec. II. 15. (3)

† *Ibid,* Dec. II. 16. (5)

‡ *Archæol. Journal,* viii. p. 96. *Cran. Brit.* Dec. I. p. 38.

§ *Canadian Journal,* Vol. VI., p. 414.

But the sources of unsymmetrical cranial deformation must be traced to other causes besides those of artificial appliances purposely employed in infancy, and of posthumous compression changing the form after death. The normal human head may be assumed to present a perfect correspondence in its two hemispheres; but very slight investigation will suffice to convince the observer that few living examples satisfy the requirements of such a theoretical standard. Not only is inequality in the two sides of frequent occurrence, but a perfectly symmetrical head is the exception rather than the rule. The plastic condition of the cranial bones in infancy, which admits of all the strange malformations of ancient Macrocephali and modern Flatheads, also renders the infant head liable to many undesigned changes. From minute personal examination I have satisfied myself of the repeated occurrence of inequality in the two sides of the head, arising from the mother being able to suckle her child only at one breast, so that the head was subjected to a slight but constantly renewed pressure on one side. This I have specially noted as developed to a very marked extent in a boy of five years old, the child of a Scottish woman, wife of a farmer in Upper Canada. He was a very sickly infant, and was consequently subjected to an unusually protracted nursing. Perhaps also, as his teeth early decayed, and he was upwards of two years old before he could walk, his bones may have been more than usually pliant. He is now a healthy boy: but his head is so flattened on the one side, and disproportionately convex on the other, as readily to attract notice. I have found, moreover, that examples of such malformation are familiar to hat manufacturers. Some of the shapes they have furnished to me are odd and fantastical; and such as could not fail to excite as general notice as other personal deformities, did not the hair suffice more or less effectually to conceal them. My attention was originally directed to this familiar test by a remark of the late Dr. Kombst, that he had never been able to obtain an English-made hat that would fit his head. He added that he believed such was the general experience of Germans, owing to the greater length of the English head. I subsequently found the shapes of a Yorkshire hatter to be shorter than some furnished me from Dublin ; and I believe that such comparisons of the shapes most in demand in different parts of the British Islands, and on the Continent, will supply important craniological results. Dr. Nott has employed the same means in his " Comparative Anatomy of Races," but only as a test of relative horizontal circumference.*

But unsymmetrical, truncated, or elongated heads may be so common as apparently to furnish distinctive ethnical forms, and yet, after all, each may be traceable to artificial causes, arising from an adherence to certain customs and usages in the nursery. It is in this direction, I conceive, that the importance of the truths resulting from the recognition of artificial causes affecting the forms of British brachycephalic or other crania chiefly lies. The contents of early British cists and barrows prove that the race with whom they originated was a rude people, ignorant for the most part of the very knowledge of metals, or at best in the earliest rudimentary stage of metallurgic arts. They were in fact in as uncivilized a condition as the rudest forest Indians of America. To prove, therefore, that like the Red Indian squaw, the allophylian British mother formed the cradle for her babe of a flat board, to which she bound it for safety, and facility of nursing, in the vicissitudes of her nomade life, —though interesting, like every other recovered glimpse of a long-forgotten past,—is not in itself a discovery of much significance. But it reminds us how essentially man, even in the most degraded state of wandering savage life, differs from all other animals. The germs of an artificial life are there. External appliances, and the conditions which we designate as domestication in the lower animals, appear to be inseparable from him. The most untutored nomades subject their offspring to many artificial influences, such as have no analogy among the marvellous instinctive operations of the lower animals. Without, therefore, running to the extreme of Dr. Morton, who denied, for the American continent at least, the existence of any true dolichocephalic crania, or indeed any essential variation of ethnic form, it becomes an important point for the craniologist to determine how far certain apparently inherent diversities of form may, after all, be traceable to undesigned artificial causes.

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* *Types of Mankind*, p. 452.

Every scheme of the craniologist for systematising ethnical variations of cranial configuration, and every process of induction pursued by the ethnologist from such data, proceed on the assumption that such varieties in the national form of cranium are constant within certain determinate limits of variation, and originate in like natural causes with the features by which we distinguish one nation from another. By like means the comparative anatomist discriminates between the remains of the *Bos primigenius*, the *Bos longifrons*, and other kindred animal remains, frequently found alongside of the human skeleton, in the barrow: and by a similar crucial comparison it is attempted to classify the crania of the ancient Briton, Roman, Anglo-Saxon, and Scandinavian, apart from any aid derived from the evidence of accompanying works of art. But if it is no longer disputable that the form of the human head is liable to modification from external causes; it becomes indispensable to assign some means for eliminating this disturbing element, before we can determine the true significance of national forms of skull. If, for example, crania from the British graves of Roman times reveal a different form from that of the modern Celtic Briton: the cause may be an intermixture of races, like that which is clearly traceable among the mingled descendants of Celtic and Scandinavian blood in the north of Scotland; but it may also be, in part, or wholly, the result of a change of national customs following naturally on conquest, civilisation, and the abandonment of paganism for christianity. When Blumenbach divided the whole human race into five classes, distinguished by physical form and colour; and Retzius found two divisions of cranial conformation, with an equal number of subdivisions, suffice for his whole system of craniology: the science was simple and of easy application. But as it grows under the combined labours of many intelligent observers, it becomes obvious that it is beset by difficulties akin to those of other sciences; and in its relations to the investigations of the comparative anatomist, it reveals the same complexities which disclose themselves to the naturalist, when turning from the study of the lower animals to man, he finds the natural history of the latter inseparable in many respects from the attributes of his moral and intellectual nature.

It is in this respect, accordingly, that the artificial causes tending to alter the natural conformation of the human head, invite our special study. They appear at present purely as disturbing elements in the employment of craniological tests of classification. It is far from improbable, however, that when fully understood they may greatly extend our means of classification; so that when we have traced to such causes certain changes in the physical form, in which modern races are known to differ from their ethnical precursors, we shall be able to turn the present element of disturbance to account, as an additional confirmation of truths established by inductive craniology. Certain it is, however, whatever, value may attach to the systematising of such artificial forms, that they are of frequent occurrence; and may be traced apparently to the following causes :—

I. Undesigned changes of form superinduced in infancy by bandaging or other custom of head-dress; by the form of pillow or cradle-board; and by persistent adherence to any unvarying position in suckling and nursing.

II. Artificial deformation undesignedly resulting from the habitual carrying of burdens on the head, or by means of straps or bandages pressing on any part of the skull, when such is continued from very early youth.

III. Artificial configuration designedly resulting from the application of mechanical pressure in infancy.

IV. Deformation resulting from posthumous compression, or any mechanical force brought into operation after death.

To the first of those I have drawn attention in more than one former paper,* and its influence I believe to be extensive and deserving of minute attention. Among the Red Indian Flatheads, where malformation of the skull is purposely aimed at, the infant's head is tightly bound in a fixed position, and maintained under continuous pressure for months. But it is a mistake to suppose that in the ordinary use of the cradle-board the pappoose is subject to any such extreme restraint. The objects aimed at are facility of nursing and transport, and perfect safety for the child. But those being secured it is nurtured with a tenderness of maternal instinct, surpassing that of many savage nations. The infant is invariably laid on its back, but the head rests on a pillow of moss or frayed soft bark, and is not further restrained in a fixed position than necessarily results from the recumbent posture in which the body is retained by the bandages securing it in the cradle. This fact I have satisfied myself of from repeated observation. But the consequence necessarily is, that the soft and pliant bones of the infant's head are subjected to a slight but constant pressure on the occiput during the whole protracted period of nursing, when they are peculiarly sensitive to external influences. Experiments have shewn that at that period the bones specially affected by the action of the cradle-board are not only susceptible of changes, but liable to morbid affections, dependent on the nature of the infant's food. Lehmann supposes the *craniotabes* of Elsässer to be a form of rachitis which affects the occipital and parietal bones during the period of suckling; and Schlossberger ascertained by a series of analyses of such bones that the 63 per cent. of mineral constituents found in the normal occipital bones of healthy children during the first year, diminished to 51 per cent. in the attenuated parts, and in some cases even to 28 per cent. in the thickened and spongy bone.* The fluctuations in proportion of the mineral constituents of bones are considerable, and vary in the different bones, but in the osseous tissue they may be stated at from 67 to 70 per cent. It is obvious, therefore, that, under the peculiar physiological condition of the cranial bones during the period of nursing, such constant mechanical action as the occipital region of the Indian pappoose is subjected to, must be productive of permanent change. The child is not removed from the cradle-board when suckling, and is not therefore liable to any counteracting lateral pressure against its mother's breast. One effect of such continuous pressure must be to bring the edges of the bones together, and thereby to retard, or arrest the growth of the bone in certain directions. Of this I have observed distinct proof in an extreme case of artificial deformation in a Flathead skull, from the occurrence of exostosis at the sutures. The same cause must tend to shorten the zygoma; whereas if it were possible to alter the adult skull by pressure similarly applied, the zygomatic arch being then fully developed, would betray its effects by bulging out, and increasing the width of the face. One element of variation in the parieto-occipital flattening resulting from the ordinary use of the cradle-board, depends on the greater or less elevation of the pillow. In many Indian skulls, where there is no indication of purposed malformation, the flattening is not in a vertical plane, affecting the occiput proper, with the posterior part of the parietal bones; but chiefly modifies the latter, extending towards the apex: as in the interesting example of a British dolichocephalic skull from the remarkable tumulus, near Littleton Drew, Wiltshire, represented on plate 24, Decade III., of the *Crania Britannica*. This I conceive to be traceable to the use of the board with a mere cover of moss or soft leather, whereby the head is thrown back so as to come in contact with the cradle-board about the region of the lambdoidal suture. Similar forms repeatedly occur among ancient British crania, and are probably traceable to the same cause.

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* *Canadian Journal*, Vol. II. p. 426, Vol. VI. *Edinburgh Philosoph. Journal*, N. S, Vol. VII. p. 25, Vol. XIV. 269.

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* Schlossberger, Arch. f. phys. Heilk. Lehmann, Physiol. Chem. Vol. III. p. 28.

One result of the recognition of this artificial source of cranial deformation was to lead me, before I left Scotland, to institute a series of careful observations on the the heads of the coal-porters of Edinburgh, and the fishwives of the neighbouring fishing villages, with a view to determine how far the heads of either are affected by their practice of carrying heavy loads by means of a leathern strap resting on the forehead; and of the bakers who bear similar loads on a board or tray laid on the top of the head. Since coming to Canada I have also made such observations as opportunity offered on the heads of Indian squaws, as they habitually support heavy burdens by a strap across the forehead. But the low flat forehead is characteristic of the Indian; and a poor frontal development may also be looked for in such a class as the coal-porters. Some of the results of those observations are given in a forthcoming work, but in all the cases referred to the pressure is only brought to bear on the full-grown head; and investigation satisfies me that the adult cranium may be subjected to extreme and oft repeated pressure without affecting its form. The process pursued by the Flathead Indians seems to show that its susceptibility to change is limited to infancy. The whole operations, by means of which the most radical change of form is produced, are effected during the first year. Whatever alteration takes place afterwards is in an opposite direction, consequent on the natural growth of the brain and skull. Accordingly the extreme deformation superinduced on the infant head among the Chinooks and other tribes of the Pacific coast is only seen to its full extent during childhood. It undergoes some modification in early youth, from the expansion of the brain in the efforts of nature to resume the normal shape. But long before puberty the head has assumed its determinate form, dependent mainly on the influences affecting it during the first year. This is the result of design; but by many apparently trifling and unheeded causes, consequent on national customs, nursing usages, or the caprices of dress and fashion, the form of the head may be modified in the nursery. The constant laying of the infant to rest on its side, the pressure in the same direction in nursing it, along with the fashion of cap, hat, or wrappage, may all influence the shape of head among civilised nations, and in certain cases tend as much to exagerate the naturally dolichocephalic skull, as the Indian cradle-board to increase the short diameter of the opposite type. Such artificial cranial forms as that designated by M. Foville, the *Tête annulaire*, may have predominated for many centuries throughout certain rural districts of France, solely from the unreasoning conformity with which the rustic nurse adhered to the traditional or prescriptive bandages to which he ascribes that distortion. All experience shows that such usages are among the least eradicable, and long survive the shock of revolutions that change dynasties and efface more important national characteristics. To such causes as the helmet of the Roman soldier, and the turban of the Turk, some writers have assigned the sources of national forms of head. But the dome of the skull acquires a firm consistency, along with its permanent shape in youth, and appears thereafter to resist all external pressure less than that which suffices to crush the bony arch, until the vital spark has fled. Then, deprived of its vascular covering, or softened by the chemical action of its decaying tissues, and subjected to moisture and unwonted compression, some of the peculiar abnormal shapes are produced, now recognised as clearly traceable to posthumous action.

But now that attention has been directed to this subject, its full bearings begin to be appreciated, and the operation of artificial causes is recognised in the modification of the dolichocephalic as well as the brachycephalic head. More recent studies in the New World have satisfied me of the occurrence of both types in the same Peruvian cemeteries,—not as examples of extreme latitudes of form in a common race, but as the results of the admixture either of conquering and subject races, or of distinct classes of nobles and serfs, most generally resulting from the predominance of conquerors. Among the Peruvians the elongated cranium pertained to the dominant race; and some of the results of later researches in primitive

British cemeteries seem to point to an analogous condition of races. In my original investigations into the physical characteristics of the primitive races of Scotland, I was led from observed facts, to separate from the others an elongated dolichocephalic type of head, for which the distinctive title of kumbecephalic was suggested,—derived from its peculiar boat-like shape,—and to arrange this provisionally as the oldest in the order of succession of Scottish cranial forms. Of the insufficiency of the data then accessible for any absolute conclusions on so important a point I was fully aware, and accordingly I remarked, when setting forth the idea with the accompanying evidence: "Of the existence of primitive races prior to the Celtæ, I think no doubt can now be entertained. Of the order of their succession, and their exact share in the changes and progressive development of the native arts which the archæologist detects, we still stand in need of further proof; and the assumed primeval position of the kumbecephalic race of Scotland is advanced here only interrogatively, and with the view of inducing others to take up the same interesting inquiry. The subject demands much more extended observation before any such conclusion can be dogmatically affirmed concerning the primitive Scottish races. We have also still to obtain the proofs of that abrupt change from the one form to the other, only to be procured as the result of numerous independent observations, but which can alone satisfactorily establish the fact of the intrusion of new races."*

The idea thus thrown out, as deduced from direct, though necessarily limited observation, had this further significance, that it either indicated the primitive races of Britain to have succeeded each other in a different order from those hitherto recognized by Scandinavian ethnologists and archæologists in relation to Northern Europe, or it pointed to a race which had preceded their oldest Allophyliæ. Its reception from the large class of antiquaries who practically believe in no world older than the Romans, could easily be guessed; but while challenged on the one hand as improbable or false, on the other it very speedily received partial confirmation from independent observations, and especially from those of Mr. Thomas Bateman of Lomberdale House, Derbyshire. In a communication to the British Archæological Association, soon after the publication of my views, Mr. Bateman states as the result of extensive investigations chiefly in the Derbyshire grave-mounds, that the chambered barrows, which he justly regards as assignable to a more remote antiquity than others explored by him, invariably yield the elongated form of cranium. "Although the mounds of this character," he remarks, "have not been numerous, the interments within the chambers they contain have been many, and apparently continued over some length of time. In these the boat-shaped (kumbecephalic) skull has uniformly been found by me, rarely accompanied by any instrument, but in one or two cases with arrow-points of flint."* To this opinion subsequent researches extending through successive years to 1858, appeared to him to lend additional confirmation; and in his "Ten Years' Diggings in Celtic and Saxon Grave Hills," published in 1861, much additional evidence is produced. On the exploration of the chambered tumulus of Ringham Low, in 1855, one of its large cists was found to contain a quantity of human bones partially disturbed. "These," he states, "have since been ascertained to include the remains of twelve individuals, comprising two infants and ten adults, mostly exhibiting the lengthened form of skull I have before observed to be constantly found in tumuli of the same description as the present."† Again, when describing researches in Longlow barrow, which led to the discovery of a megalithic cist, or sepulchral chamber, Mr. Bateman remarks: "This is the first opportunity we have had of exploring an undisturbed cist in a chambered cairn of this peculiar structure. It is on this account a discovery of unusual interest, and when compared with the results of previous or subsequent excavations in similar grave-hills, yields to none in importance. The mound, composed of stone, enclosing a chamber or cist formed of immense slabs of stone, occasionally double or galleried, indicates, in this part of the country at least, a period when the use of metal was unknown, the sole material for the spear and arrow being flint, which is often carefully chipped into leaf-shaped weapons of great beauty. The interments within these cists have in every case been numerous, and apparently long continued. They are marked by a strongly defined type of skull, styled by Dr. Wilson kumbe-kephalic, or boat-shaped, the more obvious features being excessive elongation, flattening of the parietal bones, and squareness of the base, producing, when viewed from behind, a laterally compressed appearance, which is enhanced by the sagittal suture being sometimes elevated into a ridge. The adult male skull found in the centre of the Longlow cist has been selected to appear in the *Crania Britannica*, as a typical example of this form. The crania of a female, and of a girl about seven years old, from the same cist, exhibit the same form in a remarkable degree, as do the others which are more imperfect. Crania from the chambered barrows at Bole Hill, Bakewell Moore; Stoney Low, Bassington Moor; Ringham Low, near Monyash; Five Wells Hill, Taddington, are of the same type."*

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* *Archæology and Prehistoric Annals of Scotland*, p. 177.

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* *Journal of Archæol. Association*, Vol. VII., p. 211.

† Ten Years' Diggings in Celtic and Saxon Grave Hills, p. 95.

The skull above referred to, selected from those recovered from the Long Low chambered barrow, has since been produced in the fourth Decade of the *Crania Britannica*, and in the beautiful illustrations of its form, amply bears out Mr. Bateman's remarks. Mr. J. Barnard Davis, by whom it is described, repeatedly expresses his dissent from the pre-Celtic hypothesis; and apparently maintains the idea of extreme latitudes in the variation of form from a common type. He specially notes the fact that examples of brachycephalic crania have been found in chambered barrows; and thus seeks to solve the difficulties presented by the evidence furnished from that of Long Low: "The most marked similarity, however, exists between the man's skull and that of the girl from Long Lowe. It is a very probable explanation, that the three skulls belonged to one family, and are the remains of a father, mother, and their child. This would reduce the unusual longness and narrowness to a mere family peculiarity. In this case it may be nothing more."† The word *family*, it is obvious, is used here in a singularly loose sense, including as it does husband and wife; a relationship involving no necessary uniformity in the shape of the heads. But while Mr. Davis abandoned the title of *Crania Celtica*, originally proposed by him for the great national work now far advanced towards completion, he has not found it so easy to divest himself of the ideas in which it originated. Beginning his chapter on the "Views of preceding Observers," with Julius Cæsar, and rejecting with little ceremony those of writers who are slow to believe that the oldest historic race is necessarily the primeval one, he thus closes that department of his subject:—"We have now quoted at sufficient length descriptions and opinions bearing more or less upon the people who first inhabited the forests and wilds of these Islands, after they had been rendered fit, in the sublime plans of the Divine benevolence, for the extension of intelligent happiness, by making them the abode of men. Of the Imperial invaders of these primitive people"—and so he passes on to the Romans. In this easy fashion the author takes for granted that the people found by the Romans in occupation of Britain were necessarily the descendants of those who first entered there after it had become fitted for human habitation. When enthusiastic Celtic scholars advance another favoured theory, that Welsh or Gaelic was the language of Paradise, the deduction is arrived at by very much the same process of reasoning, which assumes that the oldest known race and language must necessarily be the first. Mr. Davis having thus committed himself to opinions irreconciliable with any pre-Celtic hypothesis, its influence is repeatedly apparent in his subsequent comments on British crania. But on this very account the following description of those of the Long Low barrow is the more valuable, unbiassed as it is by any leanings to a theory in favour of the greater antiquity, or special ethnical distinction of the long-headed builders of the megalithic chambered mounds: "One of the skeletons derived from the centre of this capacious cist owned the cranium we have been permitted to delineate, now in the rich Celtic Museum of Mr. Bateman. It is a remarkably regular, narrow, and long skull, of good shape, medium thickness, and presenting few of the harsh peculiarities of the ancient British race; on the contrary, there is about it an air of slenderness and refinement. In some features it assimilates to the modern English cranium, although decidedly narrower; whilst its genuine and remote antiquity is determined by unquestionable evidence. It belongs in an eminent degree to the class of dolichocephalic skulls; and is the cranium of a man of about forty years of age." After describing the bones of the face in minute detail, he thus proceeds: "The side view shows a considerable elevation proceeding from the coronal region along the sagittal suture: a large surface, from the flatness of the skull; and a regular pleasing outline. The bosses of the parietals are not prominent, yet the area of these bones is extensive. The upper portion of the occipital projects, and terminates below in a distinct ridge and protuberance. The skull is unusually smooth and equable among the British series, and exhibits a long narrow oval when viewed vertically, slightly depressed in the left temporal region. Its widest part is just above the mastoids, so that the occipital development is not deficient, and this region is more capacious than any other."* The one female skull he describes as that of a woman of probably fifty years of age; the other that of a girl not more than seven years of age; but "it is remarkable that both, although not quite agreeing in form with that of the man, exhibit the same dolichocephalic conformation." Mr. Davis, in his concluding remarks, again reverts to the "pre-Celtic hypothesis," and adds: "If we assume with those who receive this hypothesis, that the possessors of these long crania were a race distinguished by a particular kind of sepulchres, stone chambers, or chambered barrows, it must not be overlooked that dolichocephalic crania are still met with in other barrows and cists." But this argument is based on a wholly incorrect view of the question. The Egyptians were pyramid-builders, but all Egyptians were not interred under pyramids, or in chambered catacombs. The chambered barrows cannot be regarded as common places of sepulture, but as the costly and laboriously constructed sepulchres of royal or noble dead; and in this respect their osteological contents present a striking analogy to those of the noble Inca race recovered from the ancient cemeteries of Peru, mingled with the crania of a markedly diverse type.

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* *Ten Years' Diggings in Celtic and Saxon Grave Hills*, p. 146.

† *Crania Britannica*, Dec. IV., pl. 33 (5).

Through the kindness of Dr. Thurnam, I have been favoured with his notes of a singularly interesting exploration of a chambered barrow at West Kennet, near the celebrated megalithic circles at Abury, in Wiltshire, as prepared for the *Crania Britannica.* The tumulus, he remarks, is one of the largest known, measuring 335 feet in length; and appears to have been surrounded by an inclosing range of upright monoliths surmounted by horizontal slabs, somewhat in the style of Stonehenge. It had been entered at various former periods, and bore evidence suggestive of its having been searched in Roman times. But the skeletons had only been partially disturbed; and it still contained considerable remains of primitive pottery and various implements of flint; but no traces of metal. The chamber contained six skeletons; five being probably of males, from 17 to 60 years of age, and the sixth that of an infant. With one exception, as Dr. Thurnam notes, they were of less than middle stature, and two of the skulls were remarkable for distinct traces of fracture, unequivocally inflicted before death. The following are his minute observations on the most remarkable of the crania:—

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* *Crania Britannica,* Dec. IV. pl. 33. (4)

"The principal skeleton, to which the skull described belongs, and by far the most characteristic of the series, was that of a man about 35 years of age. It was deposited in the north-west angle of the chamber, with the legs flexed against the north wall. The thigh-bone measured 17¾ inches, giving a probable stature of 5 ft. 7 in. Near the skull was a curious implement of black flint,—a sort of circular knife with a short projecting handle, the edges elaborately chipped. The skeleton was, perhaps, that of a chief, for whose burial the chamber and tumulus was erected, and in honour of whom certain slaves and dependants were immolated.

"The valuable cranium we have to describe is not only remarkable for its form and for the character of the tomb whence it was derived, but also for being restored from an extraordinary number of fragments. Notwithstanding this disadvantage, the original form has evidently been reproduced. The skull is thick, measuring nearly half an inch in the thickest part of the parietals. It is of medium capacity, and has contained a brain weighing about 50½ oz. Av., or about the average weight of the adult male brain. It is decidedly dolichocephalic, narrow, and very flat at the sides, and realizes more nearly than any we have yet had to figure the kumbecephalic or boat-shaped form described by Dr. D. Wilson. The frontal region is narrow, moderately arched and elevated, but sloping away on each side. The parietal region is long, and marked by a prominent ridge or *carina* in the line of the sagittal suture, which is far advanced towards obliteration, whilst the other sutures are quite as perfect as usual. The occiput is full and prominent; the supra-occipital ridges only moderately marked. There is a deep digastric groove, and a slight paroccipital process on each side. The external auditory openings are somewhat behind the middle of the skull, and very much behind a vertical line drawn from the junction of the coronal and sagittal sutures.* Turning to the face, we notice the decidedly full glabella and overarching brows, continued almost to the external angles of the small retangular orbits: the eyes must have been very deeply set. The narrow nasal bones are separated from the forehead by a deep indent, and are implanted at a very abrupt angle. The malar bones are somewhat flattened, and have a nearly vertical

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"* Dr. Gosse *(Déformations Artificielles du Crâne,* pp. 7, 59) concludes that when this vertical line falls either much behind or much in front of the auditory opening, the existence of artificial distortion is proved."

position; notwithstanding which, the narrow forehead and high vertex above give a decidedly pyramidal aspect to the front view of the skull, such as is considered characteristic of the Turanian type, and has before been observed in skulls from the chambered long-barrows of this country. The face has been small, short, and narrow; the superior maxilla is very short; the alveolar processes (intermaxillaries) not so prominent as in many skulls from the round barrows; and, though the upper incisors overlap the lower, the jaw is tolerably orthognathic. The teeth are medium size; the enamel of the crowns moderately reduced by attrition, but not sufficiently so to expose much of the dentine. The canine teeth are much smaller than is usual in the British series; and this is particularly obvious in the less external prominence of the fangs of these teeth in the upper jaw, upon which the semiprognathic and broad, muzzle-like character of the jaw in the skulls to which we refer seems in part to depend. In the lower jaw, which deviates considerably from the normal type, a very prominently angular and square, but narrow, chin is observed; the base is unusually thick, measuring seven-tenths of an inch at the thickest parts; the ascending rami are rectangular and broad, and the angles remarkably everted. The breadth of the base of the jaw —as is very unusual,—nearly equals the greatest breadth of the face, and adds materially to the pyramidal appearance of the front view of the skull."

Dr. Thurnam further refers to another skull from the same chamber, as one which most nearly resembles it in form. "It belonged to the skeleton occupying the south-west angle of the chamber. All its characteristics are less marked; but it bears a striking resemblance to the former skull, and, like it, presents no marks of violence: they are possibly those of brothers. The two skulls which appeared to have been fractured during life are of less elongated form, and otherwise differ from those before us,—as is consistent with the view that they belonged to slaughtered slaves, taken perhaps from some other tribe."

It thus appears that the researches of successive craniologists labouring without concert, and controlled in their deductions by diverse theories, nevertheless all point to the fact of certain marked differences distinguishing the crania of the Chambered Barrows from those of the ordinary earth-mounds and cists. The neglect of this important branch of inquiry by Sir R. C. Hoare, in his researches among the barrows of Wiltshire, has already been referred to; yet it was impossible that he could examine, even in a cursory manner, the many crania exhumed by him without acquiring some familiarity with their characteristic form. Accordingly it is of peculiar interest in relation to the present inquiry to note that when, in 1817, he communicated to the Society of Antiquaries the notice of a Chambered Barrow at Stoney Littleton, in Somersetshire, which attracted his attention as a species of tumulus altogether new to him, he concludes his description by remarking:—"I shall now request the attention of my brother Antiquaries, and especially of those versed in the science of craniology, to the two skulls discovered in this tumulus, which appear to be totally different in their formation from any others which our researches have led us to examine."* He does not enter into any general comparison, but indicates their remarkably depressed foreheads as the most noticeable feature: but the fragments of the skulls have been traced by Dr. Thurnam to the Philosophical Institution at Bristol; and their general resemblance to the corresponding portions of the Uley cranium,—one of the most characteristic of all the skulls recovered from Chambered Barrows,—is pronounced by him as sufficiently apparent.†

So obvious and constant are the points of difference between the brachycephalic crania of the ordinary earthen mounds, and the dolichocephalic crania of the Chambered Barrows, that Dr. Thurnam, in his early notice of one from Littleton-Drew, Wiltshire, asks: "Can the long-headed builders of these chambered barrows have been some Iberian or Ibero-Phœnician settlers?" But further observations on this class of crania have suggested other ideas in regard to them; and accordingly, after the description of those of West Kennet, quoted above, he takes into consideration the possible influence of artificial appliances in the production or modification of this remarkable type of head, and then proceeds: "In like manner as the Ballard Down skull (Plate 45 of *Crania Britannica*,) recalls the cranial form of many American and Polynesian tribes, so does that now described the narrow and elongated skulls of the Australians and Esquimaux. The Ballard Down skull bears marks of artificial flattening of the occiput; this calls to mind the artificial lateral flattening of the skull characteristic of the ancient people called Macrocephali, or long-heads, of whom Hippocrates tells us, that 'while the head of the child is still tender, they fashion it with their hands, and constrain it to assume a lengthened shape by applying bandages and other suitable contrivances, whereby the spherical form of the head is destroyed, and it is made to increase in length.' This mode of distortion is called by Dr. Gosse the *temporo-parietal*, or '*tetê aplatie sur les côtés*.' It appears to have been practised by various people, both of the ancient and modern world, and in Europe as well as the East. The so-called Moors, or Arabs of North Africa, affected this form of skull; and even in modern times, the women of Belgium and Hamburgh are both described as compressing the heads of their infants into an elongate form.* Our own observations lead at least to a presumption that this form of artificial distortion may have been practised by certain primeval British tribes, particularly those who buried their distinguished dead in long chambered tumuli. It has been shown by Dr. Minchin,† that an abnormally elongated form of skull may be strictly congenital, and depend on obliteration of the sagittal suture, or on the development of the parietal bones from a vertical centre, rather than from the sides. Such an explanation, however, does not seem applicable to the skulls from the chambered barrows of Britain, any more than to those of the Macrocephali of Herodotus. The premature obliteration of the sagittal suture observed in the skull before us, and to a still greater degree in that figured by Blumenbach, under the name of 'Asiatæ Macrocephali,' appears to be an ordinary concomitant of the compressed and elongate skull. On the whole, the writer thinks this obliteration has been produced by pressure or manipulations of the sides of the head in infancy, by which it was sought to favour the development of a lengthened form of skull; to which, however, there was probably, in the present instance at least, a natural and inherent tendency." Dr. Thurnam adds as a note: "The regular and ovoid form of head which now prevails in England, is probably in part due to the practice of mothers and nurses gently rubbing the heads of infants with the palm of the hand, with the object of favouring regularity of shape. In accordance with this, it has to be remarked that it is in the most degraded and neglected classes that

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* *Archæologia*, Vol. XIX., pl. 47.

† *Crania Britannica*, Dec. I., pl. 5–6.

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"* See the authorities in Gosse, pp. 55-57."

"† *Dublin Journal of Medical Science*, Nov. 1856, 'Contributions to Craniology.'"

the more striking departures from a symmetrical form of head are to be observed."

Such are the remarkable characteristics of crania recovered from ancient megalithic tombs: as those of Uley, Gloucestershire; Long Low and Ringham Low, Staffordshire; and Littleton Drew and West Kennet, Wiltshire. The tendency of the evidence, derived from independent observers, appears to confirm the idea of the prevalence of a dolichocephalic form of head at the earliest ascertained period of regular sepulture; nor are there wanting traces of such specialities in this primitive British dolichocephalic skull as induced me, when first observing it, to separate it into a kumbecephalic class, distinct from the very different oval head of the medieval and modern descendants of Britons and Anglo-Saxons. In an introductory chapter of the *Crania Britannica,* Mr. Davis remarks on my proposed classification of the succession of ethnical forms, as—1st. Primitive Dolichocephalic, or Kumbecephalic; 2nd. Brachycephalic; 3rd. Celtic: "The reader will perceive that only a slight attempt appears to have been made to discriminate the sexes to which the skulls might be referred; and that the number of examples is obviously quite inadequate for any trustworthy conclusion; further inquiry has produced a serious question of the authenticity of some of the series. The skulls of the supposed Druids of Iona and the Hebrides, Dr. Thurnam has ascertained are doubtless those of Christian monks of the eighth or ninth century."*

Of the more ancient crania referred to, including all that were then accessible, the majority wanted the teeth and lower jaw, and in eight of them the facial bones were defective or entirely absent. Under similar circumstances some craniologists appear to have no hesitation in determining the sex; but I am at a loss to comprehend the data on which their opinion is founded. The fine cranium of an ancient German, found under a tumulus in Weimar, and presented by Goethe to Blumenbach, is engraved in the sixty-first Table of his Decades as that of a woman. But it wants the under jaw, which gives so much of the character to the female skull; and to Mr. J. B. Davis's eye it "conveys the impression of its being rather the cranium of a young man."† It was not therefore without reason that I hesitated to speak with confidence, where the point was so open to dispute, though fully alive to its importance. The second clause of the critique, in speaking of the inadequacy of the number of examples, only paraphrases my own words, while at the same time it overlooks general and cumulative evidence suggestive of a hypothesis to which the special examples produced appeared to lend confirmation. Well aware that I was breaking new ground, I had myself, in summing up the deductions from examples produced, introduced certain suggestive provisional inductions with these remarks: "Such are the elements from which it has been attempted to deduce some conclusions of general import in regard to the successive primitive races that have occupied Scotland prior to the era of authentic historic record. The data are much too few to justify the dogmatic assertion of any general inferences, or to admit of positive answers to the questions naturally suggested. . . . They include, however, all the examples that could be obtained, and are in so far valuable as trustworthy examples of the cranial characteristics of Scottish races, that they have been selected from various localities, by different individuals, with no single purpose in view."* In the brevity of his note Mr. Davis has probably compressed his remarks into a form implying somewhat more than they were intended to convey; but from the remaining portion of the above comment, no reader unfamiliar with the original text, could fail to understand that I had produced certain spurious skulls as "Druids of Iona." A reference to the text will show that, in describing five crania presented to the Phrenological Society in 1833, by Mr. Donald Gregory, I mentioned that they were each marked by him as the "Skull of a Druid from the Hebrides." My own remarks are as follows: "Mr. Donald Gregory was secretary to the Iona Club, and one of the ablest Celtic scholars of his day. The designation which he affixed to the crania brought from Iona may be accepted as undoubted evidence of their having been found under circumstances which afforded proof of their high antiquity; though it is not necessary to assume from this that they had pertained to Druids. Most probably nothing more was intended by the epithet, than to indicate in the briefest manner, that he believed them to have belonged to the native population prior to the introduction of Christianity in the sixth century."† The skulls were produced by me as examples of the Celtic type. Whether they belonged to Pagan Celts prior to the sixth century or Christian Celts of the eighth, could not affect their value for the object in view. One Celtic skull, presented to me as from Harris, in the Hebrides, was subsequently found to have been from Harray, in Wales. I am unaware of any other error that can justify the "serious question of the authenticity of some of the series" produced by further inquiry; though well aware of the nature of the inquiry, as I had promptly responded to Dr. Thurnam's application, soon after the publication of my *Prehistoric Annals of Scotland*, for an opportunity of inspecting the crania referred to. I accordingly sent him those in my own collection and under my control, and exerted myself in procuring the transmission of others, with the requisite documents; a courtesy which I have found him equally ready to return. One of the documents transmitted with the skulls from the Phrenological collection consisted of the letter from Mr. Donald Gregory to Mr. Robert Cox, W. S. of the Edinburgh Phrenological Society, dated 11th September, 1833, accompanying the "Druid" skulls, and ran as follows :—

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* *Crania Britannica,* Decade I. p. 2.

† *Crania Britannica,* Dec. I., p. 25.

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* *Prehistoric Annals of Scotland*, p. 176.

† Ibid, p. 173.

"Along with this you will receive six ancient skulls* procured under the following circumstances : There is a place here called *Cladh na Druineach*, i.e., the burial place of the Druids, in which I have caused some deep cuts to be made. An incredible quantity of human bones has been found; and as it is perfectly certain that this place has never been used as a Christian church-yard, or as a place of interment at all, since the establishment of Christianity here by St. Columba, there can be no doubt of the antiquity of the skulls now sent. They are by every one here firmly believed to be the skulls of the Druids, who were probably interred here from distant parts as well as from the neighbourhood, on account of the sanctity of the island, which formerly bore the name of *Innis na Druineach*, or the Druid's Isle.

"The six skulls herewith sent were selected with care by myself, from a much larger number. One you will observe is higher in the forehead than the rest. But this is an exception; for I am satisfied,—and others whose attention I directed to the matter agree with me,—that the general character of the skulls is a low forehead, a considerable breadth in the upper and posterior part of the head, which you will no doubt readily perceive. Although, with the exception mentioned, those skulls have the same general character, (as far as I can judge,) yet there are sufficient differences in the individuals to make them of considerable interest to the phrenologist. I must not omit to mention that the present race in the island appear to have much better foreheads than the Druids, and in point of intellect and intelligence are perhaps above the average of the Highlanders and Islanders.

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* One of them existed only in fragments in the Phrenological Museum at the period when I examined the other five.

"Some of the skulls did not present such strong individual character as those sent, and were more equally developed. But, as I was limited in the number to be taken, I preferred choosing well marked skulls, particularly as the general character of the whole was so much the same."

The author of this letter, at the time that it was written, was engaged, as secretary of the Iona Club,—a society formed for the publication of ancient Celtic literature,—in superintending a series of researches and excavations in Iona, under the authority of the Duke of Argyle, the president of the Club, by means of which many of the beautifully sculptured monuments of the ancient Christian cemetery of Relig Oran were brought to light. He was at the same time secretary of the Society of Antiquaries of Scotland, a zealous archæologist, foremost among the Celtic scholars of his day, and equally zealous as a craniologist. It would be difficult indeed to name another man whose authority was deserving of equal weight on the points it is produced to substantiate.

But Mr. Davis is obviously sensitive on the whole question of a pre-Celtic hypothesis. He returns to its assault at every opportunity; as in his description of the Green Gate Hill crania, Dec. I., 34, (2) which, though they "bear a striking general resemblance," yet "whilst the one is of the brachycephalic form, the other approaches more to the dolichocephalic character." Having accordingly defined their points of difference, he thus proceeds: "These will go far to render questionable the opinion which has been assumed, that by ascending to the earliest prehistoric times ws shall find the crania endowed with uniformity, or as it were, stereotyped,"—an idea not to be met with, so far as I am aware, elsewhere. Again he reverts to the subject in describing the Wetton Hill cranium, Dec. II., pl. 12, (4); those of the Long Lowe barrow, Dec. IV., pl. 33, (6), &c. He has demolished the hypothesis, and all that relates to it as we have already seen, when dealing, in his introduction, with the "Views of previous observers," and might have been expected to reserve its *coup de grace* to the conclusion, along with "other subjects to which a review of the whole series of crania depicted is essential." But the ghost of the discomfitted hypothesis haunts him in an uncomfortable fashion, and apparently not without reason. I had not intended to revert to this subject till all the valuable data and tables of measurements of the *Crania Britannica* were completed, and the joint labours of its gifted authors had been crowned with their own final summary and deductions. But being in some degree compelled to notice it, by what appears to me an appropriation of my views on one of the points in question, after pronouncing so summary a judgment on others, I may here indicate the apparent bearings of the evidence at the present stage. Deducting from the crania already described and illustrated in the four published decades, those classed as Roman, Anglo-Saxon, and Scandinavian, the remainder admit of division into two distinct classes; 1st, those derived from Chambered Barrows and Cromlechs or Megalithic cists; 2nd, those found in ordinary barrows and cists. The following tables exhibit the results of such a classification. The first includes every skull of its class of which the measurements are given in the first four Decades, with the exception of the very imperfect cranium of a female child (C) from Long Low: and also embraces those of West Kennet chambered barrow, supplied to me by Dr. Thurnam, but which have probably been published before this appears, in Decade V. of the same work. The second table includes every skull from a British barrow or cist, in the same four Decades, with the exception of two, plates 25 and 34, both of which are so imperfect as not to supply the requisite measurements. Of the former, from Kinaldie, Aberdeenshire, Mr. Davis says, "This cranium, derived from the country of the Picts, may probably have belonged to one of that people." Its unusually short longitudinal diameter, 6.8, would have increased the difference apparent between the two classes of skulls; and the same may also be said of the Wetton Hill skull, a "remarkably elevated acrocephalic skull," with partial parieto-occipital flattening; but the longitudinal diameter is not included among the measurements given. From the illustration, however, it appears to measure 7.0 in length; so that both are below the average of the brachycephalic crania in the table, and would therefore increase the characteristic differences. The results of the comparison of such unexceptionable data, it will be seen, are no mere averages of miscellaneous crania. The measurements are: 1. *Longitudinal Diameter;* 2. *Frontal breadth;* 3. *Parietal breadth;* 4. *Occipital breadth;* 5. *Parietal height;* 6. *Intermastoid arch;* 7. *Horizontal circumference.* They supply the tests of length, breadth, height, and circumference, along with the relative frontal, parietal, and occipital breadth; and show a general uniformity distinguishing each class. This is still more apparent from the drawings; for measurements only partially illustrate certain elements of cranial classification, very obvious to the eye.

TABLE I.—CRANIA FROM BRITISH MEGALITHIC TOMBS.

| | | | L.D. | F.B. | P.B. | O.B. | P.H. | I.A. | H.C. |
|---|---|---|---|---|---|---|---|---|---|
| 1. Parsley Hay Low, Derby ... | Stone Tumulus ......... | M | 7.5 | 4.9 | 5.7 | 5.3 | 4.8 | 15. | 21.2 |
| 2. Uley, Gloucester ................ | Chambered Tumulus. | M | 8.1 | 4.7 | 5.7 | 5.0 | 5.1 | 14.7 | 21.7 |
| 3. Phœnix Park, Dublin......... | Cromlech .................. | M | 7.4 | 4.6 | 5.4 | 4.4 | 4.8 | 14.8 | 21.0 |
| 4. " " ......... | " .................. | M | 7.0 | 4.5 | 5.4 | 4.5 | 4.8 | 14.7 | 20.1 |
| 5. Littleton Drew, N. Wilts... | Cromlech .................. | M | 7.7 | 4.8 | 5.5 | 5.6 | 5.1 | 16.2 | 20.8 |
| 6. Long Lowe, Staffordshire ... | Megalithic Cist ......... | M | 7.9 | 4.2 | 5.2 | 4.4 | 5.1 | ... | 21.5 |
| 7. " " ... | " " ......... | F | 7.6 | 4.2 | 5.1 | 4.1 | 4.5 | ... | 20.5 |
| 8. Bole Hill, Derbyshire ...... | Chambered Barrow ... | M | 7.5 | ... | 4.9 | ... | 4.5 | ... | ... |
| 9. Five Well's Hill " ...... | Chambered Cairn ...... | M | 7.7 | 4.5 | 5.1 | ... | 4.6 | ... | 20.8 |
| 10. " " " ...... | " " ...... | M | 7.3 | ... | 5.8 | 4.5 | 5.1 | 14.9 | 20.7 |
| 11. Ringham Lowe " ...... | " " ...... | M | 7.6 | 4.7 | 5.2 | 4.5 | 4.9 | ... | 20.9 |
| 12. West Kennet, Wiltshire...... | Chambered Barrow ... | M | 7.7 | 4.5 | 5.1 | 5.0 | 4.9 | 15.1 | 21.2 |
| 13. " " ...... | " " ... | M | 7.6 | 4.7 | 5.5 | 5.0 | 4.9 | 15.1 | 21.2 |
| MEAN........................ | ................................ | ...... | 7.58 | 4.57 | 5.35 | 4.75 | 4.85 | 15.06 | 20.97 |

But in those, as in other examples previously referred to, the actual measurements of perfect crania, only illustrate and confirm evidence of an equally suggestive, though less definite character. Only two crania from the remarkable chambered tumulus of Uley, in Gloucestershire, have been preserved. But in the later search of Mr. Freeman, and Dr. Thurnam, in 1854, the fragments of eight or nine other skulls were recovered, and of these the latter remarks: "The fragments are interesting, as proving that the characters observed in the more perfect crania were common to the individuals interred in this tumulus. Three or four calvaria are sufficiently complete to show that in them likewise the length of the skulls had been great in proportion to the breadth." Again in the megalithic tumulus of Littleton Drew, North Wilts, at least twenty-six skeletons appear to have been found, from several of which imperfect crania were recovered, in addition to the one measured above, (No. 5,) and of those Dr. Thurnam remarks: "Eight or nine crania were sufficiently perfect for comparison. With one exception, in which a lengthened oval form is not marked, they are of the Dolichocephalic class." So also the four nearly perfect skulls from West Kennet are described as "More or less of the lengthened oval form, with the occiput expanded and projecting and presenting a strong contrast to skulls from the circular barrows of Wilts and Dorset." To these may be added those of Heslerton-on-the-Wolds, described by Mr. Bateman; and of Stoney Littleton, Somersetshire, first pointed out by Sir R. C. Hoare. Thus we have between thirty and forty skulls, all found under nearly similar circumstances, and conforming to the same elongated type.* Of the more abundant brachycephalic crania of the ordinary barrows, Table II. furnishes sufficient materials for comparison with the previous one.

TABLE II.—CRANIA FROM BRITISH BARROWS AND CISTS.

| | | | L.D. | F.B. | P.B. | O.B. | P.H. | I. A. | H.C. |
|---|---|---|---|---|---|---|---|---|---|
| 1. Ballidon Moor, Derbyshire.. | Barrow ............... | M. | 7.0 | 4.8 | 5.4 | 5.3 | 4.8 | 15.0 | 20.5 |
| 2. Green Gate Hill, Yorkshire. | " ............... | M. | 7.0 | 4.8 | 5.5 | 5.0 | 4.7 | 14 7 | 20.0 |
| 3. Arras, Yorkshire ............... | " (Bronze)... | M, | 7.6 | 4.7 | 5.6 | 5.2 | 5.2 | 15.8 | 21.1 |
| 4. Wetton Hill, Staffordshire... | " ............... | M. | 7.4 | 5.5 | 6.0 | 5.3 | 4.7 | 15.4 | 21.5 |
| 5. End Lowe, Derbyshire ...... | " (Bronze)... | M. | 7.2 | ... | ... | 5.2 | 4.8 | ... | ... |
| 6. Codford, Wiltshire ........... | " ............... | M. | 6.8 | 4.6 | 5.7 | 5.1 | 4.7 | 14.5 | 20.0 |
| 7. Juniper Green, Midlothian.. | Cist ..................... | M. | 7.0 | ... | 5.8 | 5.0 | 4.7 | 14.7 | 20.3 |
| 8. Lesmurdie, Banffshire......... | " ..................... | M. | 7.3 | ... | 6.2 | 5.0 | 4.8 | 15.5 | 21.5 |
| 9. Kennet, Wiltshire............... | Barrow (Bronze)... | M. | 7.8 | 5.0 | 5.7 | 5.4 | 5.3 | 16.1 | 21.7 |
| 10. Newbigging, Orkney ......... | " ............... | M. | 7.1 | 5.1 | 5.7 | 5.3 | 5.1 | 15.6 | 21.0 |
| 11. Caedegai, Denbighshire ...... | " ............... | M. | 7.4 | 4.8 | 5.5 | 4.4 | 4.9 | 15.2 | 21.2 |
| 12. Acklam, Yorkshire ........... | " ............... | M. | 7.7 | 4.5 | 5.6 | 5.5 | 5.1 | 16.2 | 21.6 |
| 13. Morgan's Hill, Wiltshire ... | " ............... | M. | 7.6 | 4.6 | 5.6 | 5 2 | 5.5 | 16.0 | 21.3 |
| 14. Middleton Moor, Derbyshire | " ............... | F. | 7.1 | 4.5 | 5.5 | 4.2 | 4.6 | 14.6 | 20.0 |
| MEAN ...................... | .............................. | ... | 7.30 | 4.81 | 5.68 | 5.08 | 4.92 | 15.33 | 20.90 |

The relative mean length and breadth of the two classes of crania, as shown thus far, is: Crania of the Megalithic Tombs, 7.58 by 5.35; Crania of the Barrows, 7.30 by 5.68. Supposing that further research should tend to confirm the idea that the chambered barrows, and others of the most ancient tombs, appear to be the work of a long-headed-race: it does not therefore follow that we are to look for a stereotyped kumbecephalic form, or any more absolute uniformity than is implied in the craniological postulate that the ethnical forms of the skull are permanent, and not transmutable in the different races. We may anticipate the occurrence of the same variety within certain limits as is observed in the heads of all nations, tribes, and even families; and if Dr. Thurnam's idea is correct that the kumbecephalic shape is the artificial exaggeration of a naturally lengthened skull, an additional element of variation will tend to increase the divergence from the typical form. As, moreover, the megalithic tombs are apparently sepulchral monuments of distinguished families, and not common places of sepulture, other examples of the elongated head may be expected to occur; and the race itself may have lingered long after the intrusion of its supplanters. But if the antiquity of this megalithic race is as great at I believe it to be, we owe the preservation of its crania to the secure resting-places provided by the chambered catacombs; and their discovery beyond such limits must be of rare occurrence.

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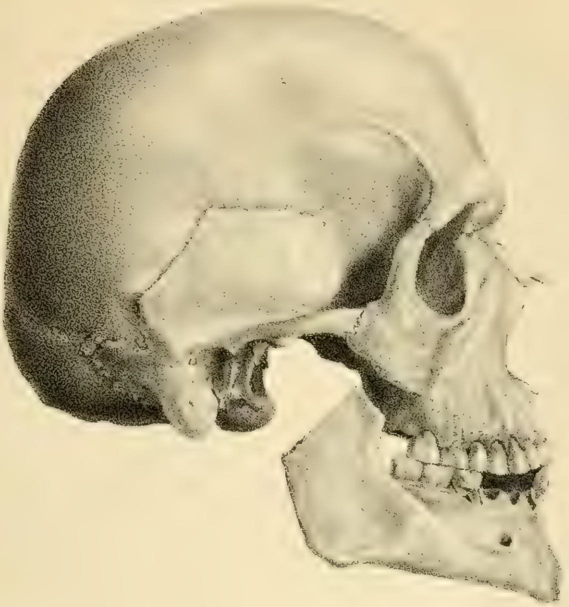
* In reality, taking all the crania of this type, including those in too imperfect a state to supply more than indications of their correspondence to the accompanying perfect crania, as referred to by Hoare, Bateman, Thurnam, and Davis, they amount to little short of sixty in number; while those of an opposite type are rare and exceptional.

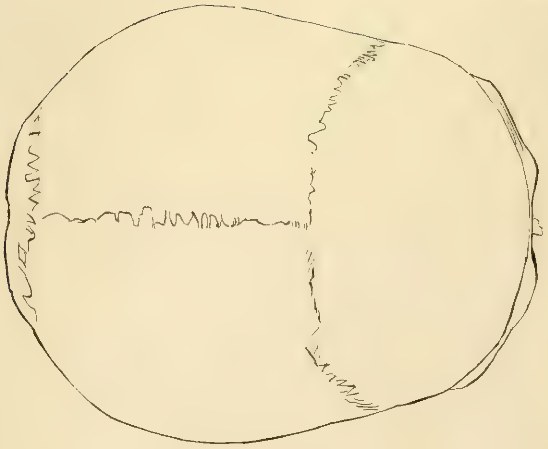
In his communication to the Academy of Natural Sciences of Philadelphia "On the Crania of the Ancient Britons," Mr. Davis deals specifically with the questions here referred to. He begins by assuming the Britons to have been, in the strictest sense, "the aboriginal people of the British Isles;" and then reverting to the general correspondence of cranial form in each race—on which, indeed, the whole science of craniology rests,—he indicates the latitude of divergence which may be looked for within such ethnical limits, and thus proceeds:—"Under these circumstances, we are prepared to expect diversity of form among the crania of the ancient Britons; but it is not unreasonable also to expect that, true to the beautiful principle of nature, of an endless diversity under a comprehensive uniformity, this diversity will be restrained within limits and be subjected to definite rules." Having thus defined the basis of his argument, he proceeds to select the Ballidon Moor, Green Gate Hill, and Codford skulls (Nos. 1, 2 and 6 of Table II.,) as representatives of the typical form of the ancient Briton; while he disposes of the long crania of the megalithic tombs under the convenient designation of *aberrant forms,* and selects the Uley skull as "an example of this peculiar aberration." This affords an opportunity for demolishing "the theory of the dolichocephalic pre-Celtic race to its very foundations;" in doing which, he remarks:—"The circumstance that these long skulls have usually been found in chambered barrows may be a mere contingency, little more than accidental." It has been shown above, that this supposed "mere contingency" has hitherto been fully as constant as the occurrence of the opposite type in the circular earth-barrows; and that, rare as such ancient examples must necessarily be, they already number upwards of thirty well identified illustrations. Let us then see how far this latitude of aberrant cranial forms is made to stretch, in order to bolster up the gratuitous assumption that the Britons of the year B. C. 51, were necessarily the lineal descendants of the primeval race that colonized the British Isles with its first human occupants, at the lowest computation, thousands of years before. The condition of the Britons when first visited by the Romans was by no means one of complete isolation; and the history of subsequent centuries is little reconcileable with the theory of a race of autochthones having held undisputed possession of the British Isles through all previous centuries since its first occupation by man. Here are Mr. Davis's own selected examples of typical and aberrant cranial forms in so far as they refer to the question under discussion, as the platycephalic and acrocephalic crania are confessedly rare and exceptional :—

TABLE III.—"TYPICAL AND ABERRANT CRANIAL FORMS."

| | L.D. | F.B. | P.B. | O.B. | P.H. | H.C. |
|---|---|---|---|---|---|---|
| Ballidon Moor skull | 7. | 4.8 | 5.4 | 5.3 | 4.8 | 20.5 |
| Green Gate Hill skull | 7. | 4.8 | 5.5 | 5. | 4.7 | 20. |
| Codford skull | 6.8 | 4.6 | 5.7 | 5.1 | 4.7 | 20. |
| Uley Chambered Barrow skull | 8.1 | 4.7 | 5.7 | 5. | 5.1 | 21.7 |

Here we have a supposed typical skull, measuring 6.8 by 5.7, and the aberrant deviation from it : 8.1 by 5.7—to speak of comparison in a case of such extreme contrast is impossible. If this furnishes a fair illustration of aberrant deviation from a typical form, what comes of "the beautiful principle of nature, of an endless diversity under a comprehensive uniformity ;" or what indeed are the practical results to be hoped for from the science, if skulls as short as the most brachycephalic Mongol, and others longer than the most dolichocephalic Ethiopian, are to be ranked as mere varieties of the same ethnical type ? With indefatigable zeal Mr. Davis has devoted himself to the task of constructing an adequate "Crania Britannica ;" and in the successful pursuit of so worthy an aim, he has proved that the mantle of Professor Samuel George Morton has fallen to no unworthy successor. But in this idea of British autochthones, *Celtic, aboriginal, primordial* and *idiogeneous* in character, it seems as if he were resolved to perpetuate the very creases and flaws of the sacred mantle : for here we have Dr. Morton's homogeneous cranial type reproduced to tramel the investigations of British craniologists, as it has already done those of America. One theoretical type is assumed, and every example which will not conform to its requirements thenceforth becomes an aberrant form. In reality, however, the only aberrant form among the above crania is the Codford skull ; while in that from Uley Barrow we have a strongly marked illustration of the essentially diverse British dolichocephalic type, which Mr. Wilde recognizes as corresponding to primitive Irish crania found under similar circumstances,





pertaining to what he designates "the long-headed aborigines of Ireland."*

During the fourteen years that have intervened since the first publication of my ideas on some of the questions now referred to, in the course of much familiar correspondence with the authors of the *Crania Britannica*, and others engaged in similar researches, I have endeavoured to help forward the discovery of scientific truth, wholly irrespective of any theories or systems of my own; not unmindful of the Laureate's rebuke:—

> Our little systems have their day;
> They have their day and cease to be.

Interrupted, as I was, in favourite studies, by transfer to other and widely contrasting scenes, I have looked on from a distance, while many zealous and enthusiastic labourers have been devoting themselves to different departments of prehistoric research, which only a few years since were unheeded or discountenanced. In 1850, the question was started in the Ethnological sub-section of the British Association, whether "craniological" papers should be permitted a hearing. But now, after an interval of twelve years characterized by extensive research in the special department of scientific inquiry under review, which, in Britain at least, had previously met with little encouragement; I may be permitted to feel some gratification in finding one of my "guesses at truth," in which I ran counter to the deductions of continental as well as British scientific observers, finding, thus far, so much confirmation from independent sources. I await with interest the completion of the labours of Dr. Thurnam and Mr. Davis, on their admirable national work; and especially the summing up of their deductions from the data there accumulated; prepared to accept the truth, whether it conform to preconceived theories or not. But meanwhile the evidence produced on various hands appears so far to coincide in revealing a dolichocephalic, if not the kumbecephalic form of cranium, as the predominant one in the chambered barrows: characterised by Mr. Davis as "unquestionably of vast antiquity;"† and without doubt the most ancient examples of regular British sepulture hitherto explored.

It has been shown by repeated references in the previous pages, that the idea of artificial causes supplying one means of accounting for aberrant cranial forms is already receiving very general acceptance, and it appears from a reference of Mr. Davis that Dr. L. A. Gosse has not only illustrated this subject at some length in relation to the extreme compression of the occiput, but incidentally notices the peculiarity referred to in Scottish and Scandinavian skulls, and traces it to the same probable source of the cradle-board. His remarks are: "Passant dans l'ancien continent, ne tardons-nous pas à reconnaitre que ce berceau plat et solide y a produit des effets analogues. Les anciens habitants de la Scandinavie et de la Calédonie devaient s'en servir, si l'on en juge par la forme de leurs crânes."*

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* *Ethnology of the Ancient Irish;* by W. R. Wilde, M.R.I.A.

† *Proceedings of the Acad. Nat. Sciences, Philadelphia,* 1857, p. 43.

There is perhaps, a danger, now that the operation of such undesigned influences is recognised, that more may be ascribed to them than is legitimate. Such was undoubtedly the effect on Dr. Morton's mind from his familiarity with the results of artificial deformation on American crania, coupled perhaps with the seductive influences of a favourite hypothesis. In his latest recorded opinions, when commenting on some of the abnormal forms of Peruvian crania, he remarks: "I at first found it difficult to conceive that the original rounded skull of the Indian could be changed into this fantastic form; and was led to suppose that the latter was an artificial elongation of a head remarkable for its length and narrowness. I even supposed that the long-headed Peruvians were a more ancient people than the Inca tribes, and distinguished from them by their cranial configuration. In this opinion I was mistaken. Abundant means of observation and comparison have since convinced me that all these variously-formed heads were originally of the same shape, which is characteristic of the aboriginal race from Cape Horn to Canada, and that art alone has caused the diversities among them."† In contrast to such sweeping deductions, the observations of Sir Robert H. Schomburgk on the Maopityans, or Frog Indians, of British Guiana, are well worthy of consideration. They are the remnant of a nearly extinct tribe. Of their cranial formation he remarks: "The flatness of the head, and consequently the long face and short circumference, is peculiar to the tribe. I have not been able to learn, upon the most minute inquiries, that the form is given to the head by artificial means. The occiput of the men is high, and almost perpendicular above the front; the frontal bone is small with regard to extent, and in no comparison to the face below the eyes; the cheek bones are harsh and prominent; but the most remarkable part of the head is the great extent between ear and ear, if measured from the upper part of that organ, and the line continued above the eyebrows to the commencement of the other ear. It surpasses the measurement of other Indians generally by an inch or two." Notwithstanding the inability of this intelligent and observant traveller to recover any traces of artificial causes influencing so remarkable a form of head, we might still be tempted to refer it to a source so familiar to the American craniologist. But three days after his arrival at the settlement, one of the women, a Maopityan, but the wife of a Taruma,—a neighbouring tribe characterised by an unusually small and differently formed head,—was delivered of a male child. Sir Robert Schomburgk states: "The Indians invited me to see the infant, and accordingly, provided with some suitable presents, I went. The newborn child had all the characteristics of the mother's tribe. It was not quite an hour old when I saw it, and the flatness of its head as compared with the heads of other tribes, was very remarkable."* Such a narrative, resting as it does on unquestionable authority, shows the danger of error in referring all seemingly abnormal cranial forms to artificial causes, and might almost tempt the theorist to recur to the idea entertained by Hippocrates, relative to the Macrocephali of the Crimea, that long heads ultimately became so natural among them that the favourite form was perpetuated by ordinary generation.

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* Dr. L. A. Gosse, quoted by Mr. Davis "*Essai sur les Déformations artificielles du Crâne;*" p. 74.

† *Physical Type of the American Indian.* Schoolcraft: p. 326.

But as we have thus derived illustrations of our subject from Europe, Asia, and America, we also find in ancient Africa a diverse form of head, to which art may have contributed, solely by leaving it more than usually free from all extraneous influences. Such at least is the conclusion suggested to my mind from the examination of a considerable number of Egyptian skulls. Among familiar relics of domestic usages of the ancient Egyptians is the pillow designed for the neck, and not the head, to rest upon. Such pillows are found of miniature sizes, indicating that the Egyptian passed from earliest infancy without his head being subjected even to so slight a pressure as the pillow, while he rested recumbent. The

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* *Journal of the Royal Geographical Society*, vol. xvi. pp. 53, 57.

Egyptian skull is long, with great breadth and fulness in the posterior region. In its prominent, rounded parieto-occipital conformation, an equally striking contrast is presented to the British brachycephalic skull with truncated occiput, and to the opposite extreme characteristic of the primitive dolichocephalic skull; though exceptional examples are not wanting. This characteristic did not escape Dr. Morton's observant eye; and is repeatedly indicated in the *Crania Ægyptiaca* under the designation, "tumid occiput." It also appeared to me after careful examination of the fine collection in the Academy of Natural Sciences of Philadelphia, that the Egyptian crania are generally characterised by considerable symmetrical uniformity: as was to be anticipated, if there is any truth in the idea of undesigned artificial compression and deformation resulting from such simple causes as the mode of nurture in infancy.

The heads of the Feejee Islanders supply a means of testing the same cause, operating on a brachycephalic type of cranium; as most of the Islanders of the Feejee group employ a neck pillow nearly similar to that of the ancient Egyptians, and with the same purpose in view: that of preserving their elaborately dressed hair from dishevelment. In their case, judging from an example in the collection of the Royal College of Surgeons of London, the occipital region is broad, and presents in profile a uniform, rounded conformation passing almost imperceptibly into the coronal region. Indeed the broad, well rounded occiput is considered by the Feejeeans a great beauty. This fact is the more important, as we are now familiar with the fact that the artificially flattened occiput is of common occurrence among the islanders of the Pacific Ocean. "In the Malay race," says Dr. Pickering, of the United States Exploring Expedition, "a more marked peculiarity, and one very generally observable, is the elevated occiput, and its slight projection beyond the line of the neck. The front is depressed, or the cranium inclines backwards, while in the Malay it is elevated or brought forward. The Mongolian traits are heightened artificially in the Chinooks; but it is less generally known that a slight pressure is often applied to the occiput by the Polynesians, in conformity with the Malay standard.'* Dr. Nott, in describing the skull of a Kanaka of the Sandwich Islands who died at the Marine Hospital at Mobile, mentions his being struck by its singular occipital formation; but this he learned was due to an artificial flattening which the Islander had stated to his medical attendants in the hospital, was habitually practised in his family.*

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* *Pickering's Races of Man*, p. 45.

Dr. Morton,—as I pointed out when first noticing the probable artificial origin of an occipital form peculiar to certain British skulls,—had already recognised undesigned artificial compression as one source of abnormal cranial conformation, and he accompanied its demonstration with a reference to the predominant unsymmetrical form in all such skulls. "This irregularity," he added, "chiefly consists in the greater projection of the occiput to one side than the other," and "is not to be attributed to the intentional application of mechanical force." Such want of uniformity in the two sides of the head is much more strongly marked in the Flathead skulls, which have been subjected to great compression. It is clearly traceable to the difficulty of subjecting the living and growing head to a perfectly uniform and equable pressure, and to the cerebral mass forcing the skull to expand with it in the direction of least resistance. Hence the unsymmetrical form accompanying the vertical occiput in the Lesmurdie and Juniper Green skulls. Wherever therefore a very noticable inequality exists between the two sides of a skull, it may be traced with much probability to designed or accidental compression in infancy; and by its frequent occurrence in any uniform aspect, may, quite as much as the flattened occiput, furnish a clue to customs or modes of nurture among the people to whom it pertains.

In so far as the preceding observations refer to British crania, and their artificial distortion, I have anticipated remarks already prepared for publication in a different form, owing to the appearance in the July number of the *Natural History Review*, of an article from the pen of Mr. Joseph Barnard Davis, entitled: "Note on the Distortions which present themselves in the cranium of the ancient Britons." In this the author begins by remarking: "During the lengthened and minute investigation of ancient British skulls, to which I have been impelled by the preparation of the 'Crania Britannica,' I have been frequently struck with a peculiar flatness in the occipital region prevailing among them. It often extends over a good part of the parietals, about the posterior portion of the sagittal suture, and over the upper part of the occipital bone. Hence I have denominated it *parieto-occipital flatness*." He next proceeds to notice the results of posthumous compression in the distortion produced by the pressure of the superincumbent earth acting constantly upon the moist and slightly plastic skull; and then proceeds thus: "Others, whose remains were inclosed in cists, kistvaens, and cromlechs, were mostly defended from the mechanical influences which produced posthumous deformation. Still the effects of this kind of compression are often evident in the occipital region. Hence they serve to interfere with our appreciation of that deformity which manifests itself in the parieto-occipital flatness. It was only after witnessing many examples in which both kinds of distortions were present, and observing that they were not coincident, but quite independent of each other, that their real distinctness became fully apparent." From observation of many artificially flattened Indian skulls, female as well as male, including those obtained from canoe-biers on the Columbia River which had never been interred, I have been led to form a different opinion, and believe that what Mr. Davis describes as "the original parieto-occipital flatness, and at the same time another distinct and non-coincident flattening, generally on one side of the occipital region which is clearly posthumous," are in reality both results of the same pressure, and produced in infancy. I cannot, moreover, conceive of any pressure on a skull inclosed in a shallow stone cist capable of affecting its shape. If so slight a cause could do so, the wonder would be that we should ever disinter a symmetrical skull, or indeed one not violently distorted. "To this subject" Mr. Davis adds, "I have directed attention in the description of the Newbigging skull in the *Crania Britannica*, plate 21, p. (4,) and more at length in the description of the Green Lowe skull, plate 41, p. (2)."

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* *Types of Mankind*, p. 436.

I think it only just to myself, and to this journal, in which my remarks on the artificial origin of the vertical occiput appeared, not only to claim priority in the publication of ideas now reproduced by Mr. Davis; but to assign my reasons for considering that he only repeats and enlarges on remarks originally produced in this journal. Under ordinary circumstances I should have left this unnoticed; but it happens unfortunately that in a forthcoming work, the sheets of which are already thrown off, I have spoken of Mr. Davis as "giving the weight of his concurring testimony" to ideas which, so far as now appears, he claims to have been the first to make known. I have not yet seen the notice of the subject referred to above, as introduced in the description of the Green Lowe skull: the Fifth Decade of the *Crania Britannica* not having yet reached Canada. That in the description of the Newbigging skull, occurs in the Third Decade, dated, in the accompanying editorial note on the wrapper, September, 1858, and reads as follows: "Regarding the cranium from behind, there is an obvious irregularity in the sides of the occiput; the right bulging out more than the left. This appearance, which is common to this and the Juniper Green and Lesmurdie crania and others, may not improperly lead us to question whether a slight distorting process may not have influenced the cranial conformation of the Britons, at least of the northern tribes."* In these remarks, published more than a year after I had in nearly similar words, suggested "whether such may not furnish an indication of some partial compression,"† &c., the writer appears to have still followed me, even in his limiting this cranial conformation to "the northern tribes." But in a subsequent and it is to be presumed later written portion of the same Decade, devoted to the description of a skull from the Caedegai barrow, on the domain of Plas Heaton, Denbighshire, where no such feature furnishes any reason for introducing the subject, he thus returns to it:—

> "In this cranium we possess the native unmodified form of head of the ancient Cymric Briton. Our description of those from Juniper Green, Lesmurdie, and Newbigging, has made known an unusual and rather abrupt flattening in the occipital region, which we consider to have been the work of art at an early period of life.‡ A few remarks upon this subject occur in the description of the last skull, where we were unable to insert any allusion to similar deformations in other races. Among the American races in general, there is so marked a flatness in the occipital region that Professor Morton was induced to regard it as one of the few typical characters of the skull belonging to the American nations, and spreading from one end of the continent to the other. This position, which is no doubt founded in truth, must be allowed to be liable to many exceptions. Yet the crania of Americans figured by Sandifort and by Milne-Edwards, the latter given as a typical skull, are both distinguished by a considerable occipital projection. Professor Daniel Wilson, of Toronto, in an able paper, (*Canadian Journal*, 1857, Vol. II., p. 406), has expressed a reasonable doubt whether this occipital flatness, or great vertical diameter, be properly a universal character of the American races, and has supported his argument by observations made upon crania disinterred in Canada, and considered to have belonged to the Iroquois and Hurons. He has also given expression to a query, which the examination of skulls remarkable for vertical diameter and flatness of occiput naturally induces, whether the American races may not owe these cranial characters, in

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* *Crania Britannica,* Decade III. pl. 21, (4).

† *Ante,* p. 403.

‡ As shown by previous extracts from the original descriptions of the Juniper Green and Lesmurdie skulls, this flattening, "the work of art at an early period of life," is an opinion subsequently adopted. It is there ascribed to posthumous deformation.

some measure at least, to artificial distortion. That nature has accorded to many of them a brachycephalic skull, and also that this feature is so marked as to be regarded as a typical character among the majority of the races of the Western Continent, may be admitted. Still, art has been frequently, almost generally, called in to heighten this conformation in a smaller or greater degree. And it is by no means improbable that its influence may be perceived among the aboriginal crania of the British Isles, especially in this greater or less occipital flatness, which is frequently unsymmetrical."

It was on the faith of this passage, that I was led to speak of Mr. Davis as confirming my views; and that I now feel some surprise on finding him refer to Gosse and other continental craniologists, while wholly ignoring the source of the idea alone originally noted by him. Certainly if the passage is critically analysed, it appears only to credit me with the theory of artificial distortion as one source of the forms in question occurring in American crania, and probably most readers may have assumed the concluding remark relative to the occipital flatness in certain British crania,—since expanded into the paper in the *Natural History Review*,—as Mr. Davis's own; but as it is little more than a repetition of remarks in the paper to which he refers in the previous sentence, and, indeed, occurring partly on the same page, where Dr. Morton's views on the subject, in its American aspects, are discussed, it can be no great presumption to believe that "if he had not plowed with my heifer, he had not found out my riddle."

# MATERIALS FOR A FAUNA CANADENSIS.

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THE difficulties attending the study of every branch of Natural History in Canada, are greatly aggravated by the want of books fitted to afford to the student, in a convenient and scientific form, such assistance as the present state of our knowledge renders practicable. A lover of Nature, who applies himself to any special department in his own locality, may collect specimens, but they will afford him very little satisfaction unless named and arranged; to which end he must have a good system, and must have characters of the received genera and known species, so that he can ascertain the history of the object he finds, if known; and if he is so fortunate as to meet with anything new, may have the means of knowing it to be so, that he may communicate his observations upon it without fear of merely repeating what others have done, and perhaps creating useless names, which encumber the science he wishes to advance. To a beginner in the study of Nature, nothing can be more discouraging than to have to search out every object in the most extensive general works (provided he is so fortunate as to have access to them) because there is as yet no attempt at a list of the productions of his country, where the limited number would facilitate his investigations.

Those who contribute local catalogues in any department of Natural History, render important assistance: but something more is required. It has occurred to me that the publication in this Journal of fragmentary portions of a *provisional* Fauna Canadensis might contribute not a little both to assist the cultivators of Zoological Science and to accumulate useful materials for future labourers who may be enabled to attempt what would now be premature,—a general systematic work on Canadian Zoology. By a provisional Fauna, we mean a systematic arrangement with the essential characters of all such genera and species as have either, to our knowledge, actually been found in Canada, or are deemed very likely to be found there—being known as inhabitants either of the more northern or the immediately southern regions. In this way, without pretending to be yet in a condition to offer any reliable account of all the living creatures inhabiting our country, we may afford useful assistance to those who are disposed to examine them, and by their labours thus assisted our conjectural list will gradually change into an authenticated record of observed facts. Many, who without such aid could do nothing, or would remain insulated collectors, unable to determine whether what they obtained was known or unknown, scarce or familiar, would be at once enabled, with a great increase to their own enjoyment from the study of Nature, to become contributors to scientific knowledge;—to assist in determining the range of species, and to call attention to hitherto undescribed forms.

There may be branches of Natural History in which the advances already made, as well as the extent and general interest of the subjects, would warrant the publication of volumes specially dedicated to their illustration. I have already announced my desire, restrained only by necessary considerations of prudence, of publishing from materials now in my hands, a *Flora Canadensis,* the utility of which I think cannot be doubtful; though no one can be more conscious than I am how much remains to be done in the way of diligent herborisation throughout all parts of the Province, and it is in promoting this interesting labour, that I think the work I propose would be especially useful. The birds which annually visit us are beginning to be well known. We have public and private museums of considerable richness. A French-Canadian gentleman—M. Lemaire—has published in his own language, a good popular account of them, which has met with well-deserved success; and we know that he has proposed to our highly-valued friend, T. W. Cottle, Esq., of Woodstock,—whom nobody excels in a familiar practical acquaintance with the birds of Canada,—to translate his work into English, with such modifications as his own judgment might suggest; thus producing an Ornithological manual for Canadians using the English language, which could not fail of giving a great impulse to this attractive branch of Zoology. Even our own means, from the extensive collection of the University, aided by local catalogues and occasional notices, would enable us to do much in relation to the birds of Canada, and we may possibly attempt a sketch of their arrangement; but for particulars respecting species, their distinctions, and their habits, we should gladly come as learners to such an authority as we have named, and we earnestly hope that he will be induced to engage in the undertaking we have referred to. We could easily name a friend who possesses admirable materials for working out several of the more difficult orders of Canadian Insecta; and there are not wanting considerable materials for the illustration of the land and fresh-water Mollusca. How far it may seem expedient to proceed with these papers we cannot yet judge; but the following fragment relating to Neuropterous Insects will at least shew what we propose, and what means are at our disposal for working out our plan.

The great class *Insecta,* includes articulate animals with jointed limbs; a distinct head, with two antennae; respiration by tracheae; and distinct sexes. It is obvious that these characters exclude, on the one hand, *Arachnida;* on the other, all grades of *Crustacea* and *Annulata,* as well as the lower form *Rotifera.* Thus defined, the class includes a lower sub-class termed *Myriapoda,* with limbs to each articulation, and whose development is not much beyond that of the larval forms of the higher division; together with the true, or *Hexa-*

*podous insecta,* having the lower appendages developed on three articulations only, and the upper, assuming the form of wings, if at all, on two articulations only. The *Apterous* examples will probably appear more certainly the more their structure is understood to be degraded forms of some of the other divisions. It is at least certain that the different groups of *Apterous* insects differ more from each other than they do from some of what are considered as higher forms, whilst there are various special instances of the absence of wings in species obviously allied to others which are furnished with them; so that on the whole, the distinction of winged and wingless insects is of little value, and the *Apterous* orders commonly received might probably be appended to others of which they are but less developed examples. The degree of importance really belonging to some other of the characters relied upon in classifying insects, is very doubtful. One much employed is the mandibulate or suctorial character of the oral apparatus, yet it has been proved that the same elements occur in both structures, and the transitions from one to the other are most remarkable. We cannot think that either the abortive hind wings of the *Diptera,* or their more completely suctorial mouth, should prevent the recognition of their close affinity with *Hymenoptera,* and we incline to the opinion that these two orders, the most peculiarly typical of all insects, would, combined together, occupy a central position in a natural distribution, around which the other leading forms might be placed in the order of their tendencies of development: 1. *Neuroptera;* 2. *Lepidoptera;* 3. *Coleoptera;* 4. *Orthoptera;* 5. *Hemiptera.* Confining our attention now to the *Neuroptera,* it seems to us, in the first place, abundantly evident that the Caddis-flies, which have been elevated into a distinct order under the name of *Trichoptera,* only exhibit a modification of the *Neuropterous* structure in analogy with *Lepidoptera.* Reviewing, then, the various sections which have been proposed, we are inclined to the following view of the families of *Neuroptera.* We place first *Libellulida,* the Dragon-flies, as exhibiting the greatest power and ferocity; 2. *Phryganeida,* the Caddis-flies; 3. *Termitida,* the White Ants, distinguished by their social habits and their large consumption of food, obtained without violence; 4. *Panorpida,* the Planipennes of authors, including several well-marked subfamilies; and, 5. *Ephemerida,* May-flies, in some respects having the lowest organisation in the order, yet approaching the *Libellulida* in their imperfect metamorphosis, as well as in the character of their antennae.

We now proceed to give a synopsis of Canadian *Neuroptera*. The following table will distinguish the families:

ORDER NEUROPTERA: Wings four, nearly equal, membranous, usually reticulate, rarely suppressed; mouth more or less completely mandibulate; never properly suctorial; larva hexopod. Antennae.

| | | | | | |
|---|---|---|---|---|---|
| very short setiform, with not more than six or seven joints | Mouth | with its parts hard and distinct, properly mandibulate | ...... | .................. | 1. *Libellulida.* |
| | | with its parts soft and indistinct | ...... | .................. | 5. *Ephemerida.* |
| long, variously-formed | Insects | not living in families; wings not caducous | Wings | generally of equal size; the under sometimes smaller, or differing in shape; not folded | 4. *Panorpida.* |
| | | | | unequal; the lower layer folded | 2. *Phryganeida.* |
| | | living in families containing many individuals with undeveloped sex; wings caducous | ...... | .................. | 3. *Termitida.* |

The curious and interesting family of *Termitida,* which in this group represents the Ants among the *Hymenoptera,* may be omitted, as being confined to tropical and sub-tropical climates. Taking the others in order, we give the following analysis of *Libellulida*, adopting Rambur's sub-families:

| | | | | | |
|---|---|---|---|---|---|
| Lateral lobes of the under lip (labial palps) | of three pieces or joints | Eyes | scarcely touching, or separate | widely separated; sometimes pedicellated | *Agrionina.* |
| | | | | touching at a point, or a little separated | *Gomphina.* |
| | | | contiguous, to some extent | .............. | *Aeschnina.* |
| | of two joints | | .............. | .............. | *Libellulina.* |

In characterising the genera, we have not thought it necessary to preserve all Hagen's new genera, but have adopted those of Rambur.

| | | | | | | |
|---|---|---|---|---|---|---|
| Genera of LIBELLULINA. | triangle of the anterior wings | well distinguished from the other areolæ, its base formed by a single nervule | Eyes | with a protrusion in the middle posteriorly | swelled like a grain | *Didymops.* |
| | | | | | not swelled (body brassy-green) | *Cordulia.* |
| | | | | without the posterior enlargement, connected in a short space | .............. | *Libellula.* |
| | | imperfectly distinguished, its base formed by two nervules | | .............. | .............. | *Nannophya.* |

Genera of AESCHNINA.

Anal angle of the posterior wings of the male rounded off; second abdominal segment of female not auriculated (abdomen with a lateral interrupted carina).............. *Anax.*

Anal angle of the posterior wings of the male acute; second abdominal segment of the female auriculated; last segment not spinous beneath.................................. *Aeschna.*

Last segment of the female spinous beneath, otherwise like *Aeschna* ............................................ *Gynacantha*

Genera of GOMPHINA.

It is only necessary to notice the two following, out of seven genera characterised by Rambur, as being alone likely to afford any species to the Canadian naturalist:

Under legs entire; triangle without nervules; eyes separated ........................................ *Gomphus.*

Under lip divided at its extremity; eyes slightly touching ........................................ *Cordulegaster*

### Genera of Agrionina.

Out of eleven given by Rambur, only three seem likely to occur to the Canadian collector, which may be thus distinguished:

Nervules of the first Costal division
- more or less numerous; pterostigma very small, or only seen in females *Calopteryx.*
- two only
  - pterostigma lozenge-shaped, small; insects of small size; areolæ quadrangular *Agrion.*
  - pterostigma parallelogram-shaped; areolæ often pentagonal *Lestes.*

## SYNOPSIS OF THE SPECIES.

### Libellulida.

### §1 Libellulina.

### Gen. Nannophya. *Rambur.*

N. bella, *Uhler.*—Black; front white, with a quadrangular black spot; dorsum of the thorax, each side with an interrupted yellow line on the male; sides with two oblique stripes and a triangular patch behind, interrupted, yellow; abdomen black, with yellow bands and spots—these parts in the female black, pruinose; wings hyaline, fulvous at the base in the male. Pterostigma small, black, terminated with a white nervule at each end in the female: length 18 millimeters; alar expansion 33 mill: rather less in the female.

*Hab.:* U. S. as far north as Maine.

### Gen. Libellula, *Linn.* (as limited by Rambur.)

#### *a.* Perithemis, *Hagen.*

L. Domitia, *Drury.* (Perithemis Domitia, *Hagen.*)

Posterior lobe of the prothorax large, broad, bilobed; abdomen much shorter than the wings, broad, depressed, narrower at the base; flavescent, villose; dorsum of the abdomen with an interrupted brownish-black line on each side; wings flavesecnt, or at least the basal half, with two fuscous, transverse stripes, the internal one often almost absent in the female; pterostigma rufo-fuscous. In the Northern var. the sides of the thorax fuscous with two interrupted yellow lines on each side: all the wings of the male with a basal fuscous point. Length 23 millim.; alar expanse 36 millim.; pterostigma 2 millim.

*Hab.:* U. S. as far north as the States of N. Y. and Mass.

*b.* Diplax, *Charpentier*. Posterior lobe of the prothorax large, broad, bilobed; abdomen a little shorter than the wings, slender, triquetral, compressed at the base; feet long, slender; first sector of triangle sinuated; triangle moderate, broad.

L. HUDSONICA, *Selys*. Very near to the European *L. dubia* (which is thus described: *L. dubia*, black; front white, labium black, labrum white, margined with black; vertex and band before the eyes black; thorax obscure brassy-green, with brown villosity; dorsum with a subinterrupted fulvous stripe on each side; sides spotted with fulvous; feet black; abdomen slender, triquetral, the dorsum spotted with yellow; wings hyaline or fumose, anterior pair with two basal points, posterior with a point and a triangular spot at the base, black; pterostigma quadrangular; nigro-fuscous. Length 37 millim.; alar expanse 58 millim.; pterostigma 2 millim.

*Hudsonica* is smaller; the basal spot of the posterior wings small; the vortex yellow above; the labrum scarcely margined with black. Length 27 millim.; alar expanse 46 millim.

*Hab.:* Hudson's Bay, New Brunswick.

### L. INTACTA.—DIPLAX INTACTA, *Hagen*.

Fuscous; mouth and front white; labium of adult male all black, of fem. black in the middle; front with a black band before the eyes; vertex black, with a pale spot, or all black; thorax nigro-fuscous; dorsum with obsolete fulvous stripe on each side; sides fuscous, varied with black; thorax of adult male brassy-black; abdomen short, somewhat broader before the apex; fuscous, with dorsal phalarate fulvous spots: in the adult male black, with a yellowish spot on 7th segment; wings hyaline, posterior ones at the base with a triangular black spot; base flavescent in the females; pterostigma short, quadrangular, black. Length 32 millim.; alar expansion 52 millim.; pterostigma 2 millim.

*Hab.:* U. S. Wisconsin, Chicago, Mass.

L. RUBICUNDULA, *Say.*—DIPLAX RUB., *Hagen.*

Yellowish subrufescent; front yellowish, with a black band before the eyes; thorax rufous, the sides sometimes luteous; feet black; anterior femora luteous beneath; abdomen rather long, slender, sanguineous in the male, or yellowish rufous; the sides with a maculose black stripe; wings hyaline, the extreme base yellowish; pterostigma quadrangular fuscous,, pale at each end. Length 32–37 millim.; alar expanse 50–58 millim.; pterostigma 2 millim.

*Hab.:* U. S. Mass., &c.

L. ASSIMILATA, *Uhler.*—DIPLAX ASS., *Hagen.*

Yellowish; mouth and front pale yellow, a narrow black band before the eyes; dorsum of the thorax luteous, its sides yellow; abdomen slender, the base compressed, inflated, yellowish; dorsum of first and second segments black at the base; segments 4–9 each side, with a marginal black stripe; wings hyaline, the base flavescent; males with the basal half flavescent; pterostigma short, yellow. Length 33–37 mllim.; alar expanse 56–60 millim.; pterostigma 2½ millim.

*Hab.:* U. S.—N. W. States.

*c.* Mesothemis, *Hagen.*—Posterior lobe of prothorax large, broad, bilobed; abdomen a little shorter than the wings, narrow, triquetral, the base compressed, somewhat expanded before the apex; feet long, rather strong; first sector of triangle sinuated; triange moderate narrow; sides of eighth segment of the female not dilated.

L. SIMPLICICOLLIS, *Say.*—MESOTHEMIS SIMPLICICOLLIS, *Hagen.*

Yellowish-green; mouth and front yellowish; a narrow black band before the eyes; thorax yellowish green, the sides varied with black below; abdomen compressed at the base, vesiculose, triquetral, yellowish-green, the sutures and margins black; segments 4-10, with a quadrangular black dorsal spot behind; last segments sometimes altogether black; venter obscure; appendages yellow; feet black, anterior femora yellowish beneath; wings hyaline; pertostigma oblong, yellow. Adult male with the thorax and abdomen blue pruinose. Length 41–45 millim.; alar expansion 60–70 millim.; pterostigma 3½–4 millim.

*Hab.:* U. S. as far north as Illinois, Pennsylvania, N. Y., Mass.

*d.* Libellula, *Hagen.*—Posterior lobe of prothorax small, entire; abdomen stout, rotundo-triquetral, narrowing posteriorly; triangle narrow, long, first sector sinuated.

L. QUADRIMACULATA, *Linn.*

Reddish yellow, villose; front pale, terminated with black; sides of thorax yellow, lineated with black; feet black; abdomen attenuated at the apex; fuscous behind; sides yellow; wings yellow at the base anteriorly, a costal spot, and sometimes an apical one; posterior wings with a triangular spot at the base, reddish black, veined with yellow; pterostigma brownish black. Length 48 millim.; alar expanse 80 millim.; pterostigma 4 millim.

*Hab.:* Northern U. S.; Canada.

*e.* Plathemis, *Hagen.*—Posterior lobe of prothorax small, entire; abdomen short, broad, depressed; legs stout, short; pterostigma long, oblong; front sector of triangle sinuated; triangle narrow, long; eighth segment in the female dilated at the sides.

L. TRIMACULATA, *De Geer.*—PLATHEMIS TRIMAC. *Hagen.*

Rufescent; thorax with two oblique yellowish stripes at each side; abdomen of the male pruinose; female with lateral oblique yellow spots, margined with fuscous; feet black; base of the femora rufescent; wings hyaline, a basal, longitudinal stripe, which is margined inferiorly with lacteons on the posterior wings and a broad band in the middle, in the male; or with the basal stripes a spot upon the middle anteriorly, and the apex fuscous in the female; pterostigma fuscous. Length 40 millim.; alar expanse 70 millim.; pterostigma 5 millim.

*Hab.:* U. S. widely diffused, reaching to Maine and Minnesota.

CORDULIA, *Leach.*

C. SEPTENTRIONALIS, *Hagen.*

Brassy-green, hairy; labium luteous; front brassy-green above, each side with a yellow spot; vertex brassy-green; thorax brassy-green, the dorsum having a spot at each side at the wings, and the sides each two maculose stripes, yellow; feet black, anterior femora yellowish at the base; abdomen slender, behind the base inflated; then attenuated, with the apex equal, brassy-black, sides of the base and apex luteous; wings hyaline, the posterior ones with a small basal triangular brownish-black spot; pterostigma small, fulvous; anal angle in the males subacute. Length 43 millim.; alar expanse 60 millim.; pterostigma 2½ millim.

*Hab.:* Labrador.

### C. ALBICINCTA, *Hagen.*

Brassy-green, hairy; labium luteous, front inferiorly, and at the sides luteous, above and the vertex brassy-green; thorax bright green-brassy; feet black; abdomen slender, inflated at the base, then slenderer, the apex equal, brassy-black, the base on each side and the last segment at the apex being luteous; wings hyaline, anterior margin in the females subflavescent; pterostigma fulvous; anal angle of the males subacute. Length 48 millim.; alar expanse 66 millim.; pterostigma 3 millim.

*Hab.:* Labrador.

Several other species have been attributed to Canada and Nova Scotia, but their characters are not given.

## Subf. AESCHNINA.

### AESCHNA, *Fabricius.*

### Æ. HEROS, *Fabr.*

Fuscous, marked with yellowish-green; front obscure luteous, fuscous above, each side with a yellowish green spot; occiput of the female bifid; thorax fuscous, with a stripe at each side of the dorsum; angulated at the wings, and the sides with two oblique stripes, green; feet black, base of the femora subrufous; abdomen long, stout, hardly broader at the base, fuscous, the base, middle, and apex of the segments with a subinterrupted, narrow, green fascia; wings hyaline, subflavescent in the middle, the apex sometimes infuscated; pterostigma long, narrow, fulvous. Length 85–96 millim.; alar expanse 108–120 millim.; pterostigma 5–6 millim.

*Hab.:* U. S. Indiana, N. Y. Mass. and Southward.

### Æ. CONSTRICTA, *Say.*

Brownish-black, spotted with green and blue; labrum yellow; head yellowish-green in front, with a black T spot above; thorax fuscous, dorsum with a stripe on each side, which is broader at the wings, the sides each with two oblique green stripes; feet black, femora and tibiæ above rufous; abdomen long, equal, blackish fuscous, very much narrowed behind the inflated base; segments 3–10, with two dorsal, apical, quadrangular blue spots, 3–8 with two medial triangular yellow spots, each side with a basal divided blue spot; second segment with a basal dorsal line, each side with a transverse line upon the middle, yellow, the last segment flat above; wings hyaline, pterostigma small, fuscous. Length 70 millim.; alar expanse 96–100 millim.; pterostigma 3 millim.

*Hab.:* U. S. Wisconsin, Indiana, Pennsylvania, Connecticut.

### Subf. GOMPHINA.

#### CORDULEGASTER, *Leach.*

##### C. OBLIQUVS, *Selys.*—Æ. OBLIQUA, *Say.*

Black, spotted with greenish yellow; head yellow, with two black bands in front, occiput tuberculoid; thorax black with grey hairs, dorsum with a cuneiform stripe on each side, sides each with two oblique yellow stripes; feet black, base of the femora fuscous; abdomen long, equal, black, dorsum with a greenish-yellow central line, which is dilated in the middle on segments 5–8; wings hyaline, pterostigma long, fulvous. Length 83–88 millim.; alar expanse 112–124 millim.; pterostigma 6 millim.

*Hab.:* U. S. Indiana, Connecticut, and Southward.

#### GOMPHUS, *Leach.*

##### G. PARVULUS, *Selys.*

Black; head black, a fascia in front and two yellow spots; thorax black, dorsum with a small yellow line on each side; sides yellow, with two contiguous stripes and a third posterior, black; feet black; abdomen equal, black, the dorsum with a basal maculore yellow stripe; wings hyaline; pterostigma blackish, fuscous. Length 40 millim.; alar expanse 54 millim.; pterostigma 3 millim.

*Hab.:* Nova Scotia.

##### G. SPICATUS, *Hagen.*

Fuscous spotted with luteous; head pale yellow; thorax clothed with fuscous hairs, dorsum with a stripe on each side, and the sides with two stripes, luteous; femora luteous, fuscous above; tibiae blackish fuscous, exteriorly yellowish, tarsi black; abdomen equal, inflated at the base, fuscous, the dorsum with an interrupted yellow line, the base with a yellow stripe at each side; wings hyaline, pterostigma yellow. Length 49 millim.; alar expanse 60 millim.; pterostigma 3 millim.

*Hab.:* N. Y., Canada.

G. COLUBRINUS, *Hagen.*—OPHIOGOMPHUS, COL., *Selys.*

Greenish-yellow; head yellow, with four black lines, labium black in the middle; thorax greenish-yellow, a middle stripe, and one on each side, narrow fuscous; sides each with three narrow black lines; feet yellow, the posterior femora exteriorly fuscous, tibiae black, with an exterior yellow line; abdomen cylindrical, dilated before the apex, the dorsum black, segments 3–7 with a basal yellow stripe, the rest with a yellow spot; wings hyaline, pterostigma pale fuscous. Length 50 millim.; alar expanse 64 millim.; pterostigma 3 millim.

*Hab.:* Hudson's Bay.

Subfam. AGRIONINA.

AGRION., *Fabricius.*

A. VIOLACEUM, *Hagen.*

Violaceous: head with a transverse black stripe above, a large violaceous occipital spot on each side; posterior margin of the prothorax rounded, subexcised in the middle; dorsum of the thorax violet, with a narrow medial black stripe: sides pale violet, a bifid stripe above at the wings, and a line upon the middle black; feet pale, femora exteriorly, tibiae interiorly, and the whole of the tarsi black; abdomen violet, varied with black; abdomen of female yellowish-green, varied with black; wings hyaline, pterostigma rhomboidal fuscous. Length 33–36 millim.; alar expanse 40–44 millim.

*Hab.:* U. S. Mass. Connecticut, New York, Pennsylvania, Illinois.

A. SAVCIUM, *Burm.*

Red; head black above in the male, blackish fuscous in the female; posterior lobe of the prothorax short, the middle subdepressed; dorsum of the thorax black in the male, red in the female, sides yellowish-red; feet pale yellow; abdomen red, the seventh segment with the sides at the apex black, the remaining segments black: in the female the apex of the seventh segment has a point on each side; wings hyaline, pterostigma rhomboidal fuscous. Length 26–22 millim.; alar expanse 31–27 millim.

*Hab.:* U. S. Illinois, Pennsylvania, Maine, Mass. and Southward.

A. THASTATUM, *Say.*—A. ANOMALUM, *Rambur.*

Brassy-green, varied with orange and yellow; head brassy-green in front, with an orange occipital point at each side; prothorax with the posterior lobe somewhat produced in the middle; dorsum of the thorax brassy-green, with a narrow yellow stripe on each side; sides yellow, brassy-green above, with a black stripe at the wings below; feet yellow, apex of the femora with an exterior black stripe; abdomen yellow, segments 1–2, having the dorsum brassy-green, the rest spotted with brassy-green, somewhat varied according to age; the tenth segment has a long process upon the middle, oblique, cylindrical, and bifid at the apex; wings hyaline, pterostigma of the posterior ones rhomboidal, black, of the anterior larger, rufous, surrounded with yellow, not attaining to the costal margin. The female differs in having more orange on the head, thorax, and abdomen, and the pterostigma of each of the wings regular yellowish. Length 23-27 millim.; alar expanse 23–30 millim.

*Hab.:* U. S. Indiana, Maine, Mass. and Southward.

### A. IRENE, *Hagen.*

Bright brassy-green; head yellow in front; third article of the antennæ aunulated with pale colour; posterior margin of the prothorax broad triangular in the male, biemarginated in the female; dorsum of the thorax bright brassy-green, sides yellowish, brassy-green above; feet pale, exteriorly lineated with black; abdomen slender, brassy-green; the sides and a basal lunule on segments 3–6 yellow; segment 8 with an apical spot, 9 with a triangular dorsal one, 10 almost alogether blue in the male, 9 blue at the sides, 10 at the apex in the female, margin of 10th segment excised dentated; wings hyaline, pterostigma short, rhomboidal, luteous Length 25–28 millim.; alar expanse 28–30 millim.

*Hab.:* U. S. Chicago, Wisconsin, Illinois.

## LESTES, *Leach.*

### L. FORCIPATA, *Rambur.*

Brassy.green; mouth yellow; dorsum of the thorax brassy-green in the male, with a middle line and stripe on each side yellow in the female; sides yellow, with a superior green brassy stripe, dilated at the wings, or the male with an inferior black stripe; feet yellow, femora bilineated with black, interior of tibiae and tarsi black; abdomen brassy-green with yellow sides, pruinose at the base and apex in the male, a basal lunule upon the segments yellow; wings hyaline, pterostigma black, margined with yellow at the sides. Length 35 millim.; alar expanse 40 millim.; pterostigma $1\frac{1}{2}$ millim.

*Hab.:* U. S. Chicago, Wisconsin.

### L. HAMATA, *Hagen.*

Brownish-brassy; mouth yellow; dorsum of the thorax brown-brassy, with a median line and a broad stripe on each side, narrowed at the wings, yellow; sides yellow, pruinose with a superior broad brown-brassy stripe and a black spot upon the pectus; beneath yellow; feet yellow, femora exteriorly, tibiae interiorly, and tarsi black; abdomen obscure green-brassy, with a basal yellow lunule to the segments; wings hyaline, pterostigma oblong, black, the sides margined with yellow. Length 42–38 millim.; alar expanse 45–43 millim.; pterostigma 1½ millim.

*Hab.*: U. S. Chicago, Wisconsin; also Red River.

### L. UNGUICULATA, *Hagen.*

Green-brassy; mouth yellow; dorsum of the thorax brassy-brown, a median line and narrow stripe on each side yellow; sides yellow pruinose, with a broad superior brassy-brown stripe, and a black broad vitta below; beneath yellow; feet yellow; femora bilineated with black, tibiae interiorly and tarsi black; dorsum of the abdomen green, the apex brown-brassy, a yellow lunule at the base of the segments, base and apex of the tergum pruinose, the sides yellow, venter black; wings hyaline, pterostigma oblong fuscous, the sides margined with yellow. The inferior fascia of the thorax wanting in the female. Length 40–30 millim.; alar expanse 43–37 millim.; pterostigma 1¼ millim.

*Hab.:* U. S. Chicago, Wisconsin, New York.

### L. EURINA, *Say.*

Blue, varied with green and violet; mouth yellow; dorsum of the thorax with a yellow stripe on each side, which is cleft and dilated at the wings; sides yellow; abdomen blue, segments green at the apex; venter black; feet black, femora beneath and tibiae exteriorly pallid; wings hyaline, pterostigma black. Length 47 millim.

*Hab.:* U. S. Mass.

### L. RECTANGULARIS, *Say.*

Brassy-fuscous; mouth yellow; dorsum of the thorax brassy-brown, with a median line and broad stripe at each side narrowed in front, yellow; sides pale yellow, with a brassy-brown stripe superiorly, and two linear black spots posteriorly; feet yellow, femora exteriorly, tibiae interiorly, and tarsi black; abdomen long, very slender, yellow, the dorsum fuscous, apex of the segments black, with an interrupted yellow basal lunule; apical segments entirely blackish-fuscous; wings hyaline, the costa yellow, pterostigma short, the sides a little oblique, black. Length 53–41 millim.; alar expanse 49–41 millim.; pterostigma 1¼ millim.

*Hab.:* U. S. Chicago, Minnesota, Indiana, Pennsylvania, New York, Mass.

### CALOPTERYX, *Leach.*

C. VIRGINICA, *Drury ed. Westwood.*—C. DIMIDIATA, *Rambur.*

Brassy-green, shining; labium, antennae, thoracic sutures, pectus, venter, and feet black; abdomen with the dorsal stripe, venter with segments 8–10 yellow; wings narrow, hyaline, the base somewhat flavescent, the apex blackish-fuscous; pterostigma in the female snow-white. Length 50–52 millim.; alar expanse 70–72 millim.; pterostigma 2 millim.

*Hab.:* Hudson's Bay, U. S. Mass. and Southward.

C. MACULATA, *Beauv.*—C. HOLOSERICCUS, *Burm.*—
C. PAPILIONACEA, *Ramb.*

Brassy-green or blue, shining; labium, antennae, thoracic sutures, pectus, venter, and feet black; abdomen with a dorsal yellow stripe, 8–10 segments in the female; wings very broad, densely reticulated, black, sometimes with hyaline spots in the male, or clouded with fuscous, and fuscous at the apex, the female with a snow-white pterostigma. Length 38–48 millim.; alar expanse 63–65 millim.; pterostigma 2–2½ millim.

*Hab.*: U. S. Chicago, Mass. and Southward. A species common and widely diffused.

C. APICALIS, *Burm.*

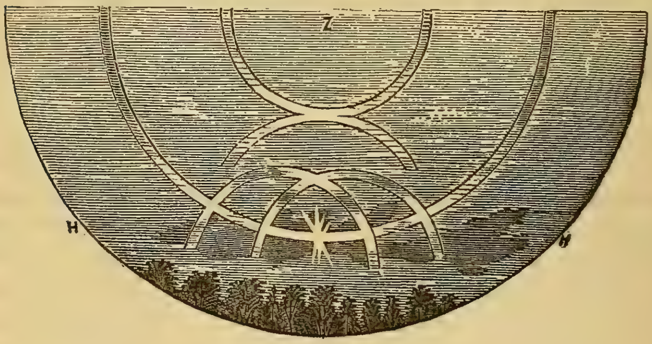
Brassy-green, shining; labium, antennae, thoracic sutures, and pectus black, or in the female in part flavescent; feet long, black, with long cilia; wings narrow, hyaline, or with the apex narrowly fuscous, pterostigma absent. Length 42 millim.; alar expanse 62 millim.

*Hab.:* U. S. Pennsylvania, Mass.

# NOTICE OF MOCK SUNS, AS SEEN NEAR THE MUSKOKA RIVER IN NOVEMBER, 1861.

### BY A. CLIFFORD THOMSON, P. L. S.

While camped near the mouth of the Muskoka River, Canada West, on the 10th of November, 1861, I observed at about 9.40 A.M., the somewhat remarkable phenomenon of seven mock suns, as shewn in the accompanying sketch. In this drawing the H. H. represents the horizon, and the point *z.* the zenith. Unfortunately, I had not any instrument with me at the time, to enable me to note the position of the halos; but two of these were quite excentric, both with regard to the sun and the zenith. The sun was too bright to be regarded with the naked eye, though the atmosphere was slightly hazy. The wind was light, and from the N. W.



I venture to send this brief notice to the *Canadian Journal*, as I believe the phenomenon to which it refers, is rarely witnessed in so southern a latitude. It was observed on this occasion at Orillia and other places more or less distant from the point at which the above sketch was taken on the Muskoka River. The latitude of this point is 45° 10′ N.

## REVIEWS.

*Isca Silurum; or, An Illustrated Catalogue of the Museum of Antiquities at Caerleon.* By John Edward Lee, F. A. S., F. G. S., Honorary Secretary to the Monmouthshire and Caerleon Antiquarian Association. London: Longman, Green, Longmans and Roberts, Paternoster Row. 1862.

Caerleon, in Monmouthshire, in which the second Legion was stationed for many years during the Roman occupation of the island, has long been celebrated for the ancient relics which have been found there. Of these there has been no more zealous or successful collector than the author of the work now under review. Indeed, it is chiefly to his exertions that antiquaries are indebted for the extensive and interesting Museum in which are preserved so many memorials of Isca Silurum.

The first work which Mr. Lee published on the subject appeared in 1845. Its title was "Delineations of Roman Antiquities found at Caerleon (the ancient *Isca Silurum*) and the neighbourhood." This was succeeded in 1850 by a "Description of a Roman building and other remains lately discovered at Caerleon." In the "Illustrated Catalogue," which has recently appeared, Mr. Lee has combined the substance of the two former volumes with an account of recent discoveries. The work also contains a notice of the excavation, directed by Octavius Morgan, Esq., M.P., at Caerwent, (the ancient *Venta Silurum*) which produced some of the best specimens in the Museum; a full abridgement of a valuable paper on the early history of Caerleon by Thos. Wakeman, Esq.; and fifty-two lithographic illustrations; all the plates being either transferred from the author's own etchings, or drawn by him direct upon the stone. These illustrations form a most valuable portion of the volume, as they are drawn with more than ordinary care and are perfectly reliable as faithful copies. In the literary part of the catalogue, Mr. Lee obtained assistance from some of the most highly esteemed authorities in Archæology. He makes his acknowledgments to Professor Mommsen and Dr. E. Hübner of Berlin; to Octavius Morgan, Esq., M.P., Rev. C. W. King, M.A., Albert Way, Esq., A. W. Franks, Esq., W. S. Walford, Esq., Thos. Wakeman, Esq., Henry Montonnier Hawkins, Esq., C. Roach Smith, Esq., and Dr. Thurnam, of England; and to the Rev. Dr. McCaul, of Canada.

The principal part of the volume is occupied by the Roman remains, which, in consequence of their numbers, are placed first. The few Celtic antiquities are next described; then the fragments which may be called early Welch; and lastly the Mediæval remains and the objects of later date. In the description of the Roman remains the arrangement of Mr. Wilde, in the Catalogue of the Museum of the Royal Irish Academy, has been adopted; and they are classed under the heads of stone, earthen, vegetable, animal, and metallic materials, —the coins being described last. Of the Numismatic relics, of which there are specimens beginning with Claudius and ending with Honorius and Arcadius, a well prepared list has been furnished by the Rev. C. W. King, so favourably known by his valuable contributions to our knowledge of antique gems. Of the Latin inscriptions there are —exclusively of those on fictile remains—about twenty that are perfect, some on altars and tablets and others on grave-stones. The most remarkable of these is the following:—

IMPP · VALERIANVS ET GALLIENVS
AVGG · ET VALERIANVS · NOBILISSIMVS
CAES · COHORTI · VII · CENTVRIAS · A SO
LO RESTITVERVNT · PER · DESTICIVM IVBAM
VC LEGATVM · AVGG · PRPR · ET
VITVALSIVM LÆTINIANVM LEG LEG
II · AVG · CVRANTE · DOMIT · POTENTINO
PRAEF · LEG · EIVSDEM.

*i.e.*, Imperatores Valerianus et Gallienus Augusti et Valerianus nobilissimus Cæsar cohorti (not *cohortis*, as Mr. Lee gives it) septimae centurias a solo restituerunt per Desticium Jubam virum clarissimum legatum Augustorum propraetore et Vitulasium Laetinianum legatum legionis secundae Augustae curante Domitio Potentino praefecto legionis ejusdem.

This inscription has two peculiarities which we have not observed in any other. The first is the use of *centurias* which Mr. Lee correctly explains as meaning "*soldiers' quarters*,"—the other, which Mr. Lee does not notice, is the singular mention of a legate and a praefect at the same time in the same legion. Of this the most probable explanation seems to us to be, that Domitius Potentinus was *praefectus castrorum*.

In the restoration and interpretation of the less perfect inscriptions, we notice two examples from amongst those found at Caerleon, but not now in the Museum, in which the ingenuity and learning of a distinguished fellow-townsman, whose communications have occasionally enriched our own pages, are remarkably displayed. After copying the several inscriptions from the works in which they are preserved, Mr. Lee says, "It had not been my intention to have suggested any reading or made any remark on the inscriptions given above in type, and which are not now in the Museum ; but while these sheets are in the printer's hands, the Rev. J. McCaul, LL.D., of Toronto, has favoured me with a letter containing many curious observations respecting them. It is his intention shortly to collect into a volume his 'Notes on Roman Inscriptions in Britain ;' but as he very liberally allows me to make use of his communication, I cannot resist giving extracts from his letter which refers to two of these inscriptions."

We copy the inscriptions as given from Coxe's History of Monmouthshire, and add to each Dr. McCaul's note. The eighth inscription runs thus :—

DEDICATV
VRF
OG ES
VE NIO
MAXIMOIE
FVRPANo
COS

Dr. McCaul says : "This inscription evidently meant the dedication or inauguration of some buildings ; and as usual the *consuls* are stated. Read the last three lines thus :—

MAXIMO $\overline{\text{II}}$
ET VRBANO
COS

*i.e.*, A.D. 234."

The ninth inscription is thus given :—

DD
VIIII
OCCB
PRCR
EIML
COS
CVR
VRSO
AGTÆ
EI : IVS

The fixing of the date to the very day by Dr. McCaul is highly interesting. He says: "In this inscription, read the second to the sixth lines thus:—

$\overline{\text{VIIII}}$
OCTOB
PRGR
ET EMIL
COS

*i.e.*, Sept. 23rd, A.D. 244, in which year Peregrinus and Aemilianus were consuls."

To many who are able to appreciate and enjoy the results, the skill here manifested will appear almost magical. In fact, if to a thorough knowledge of the Latin language we add familiarity with the ancient modes of writing and inscribing, and with the phraseology of inscriptions as acquired by a comparison of all those which have been preserved and collected, and suppose also the sort of quickness which practice gives in any peculiar exercise of the mind as well as the body, we can well understand how the thing is done, whilst we cannot but admire the patience, ingenuity, and learning which are so successfully brought to bear upon the subject.

There is another restoration of Dr. McCaul's mentioned by Mr. Lee in a note to a fragment of a Legionary stamp, figured on Plate xxiii., fig. 19. He says: "It may be well here to mention a unique and very singular impress which was found at Caerleon, and which was given many years ago by Mr. King to the museum at Cambridge. A sketch of it will be found in the 'Delineation of Roman Antiquities at Caerleon,' but it is not drawn here, as this Catalogue is confined to objects in the museum. The letters LEG are lost; the remainder consists of the usual stamp IIAVG together with a monogram which may stand either for MV or MA followed by a T. The whole stamp may, therefore, be read either IIAVGMVT or IIAVGMAT: Mr. King's opinion decidedly leans to the first." The author then quotes the opinions of Mr. Bunbury and Mr. King, and seems about to give up the subject in despair of obtaining any satisfaction; but he adds "While the above was in the printer's hands, the Rev. J. McCaul, LL.D., of Toronto, kindly communicated the following note, which doubtless is the correct reading of this stamp: "read LEG · II · AVG · ANT ·, i.e., *Antoniniana*. From Orelli, n. 2129, we learn that the title *Antoniniana* was borne by the LEG · II · A · P · F · scil · *adjutrix, pia, fidelis;* the same mentioned in one of the Bath and one of the

Lincoln inscriptions." Those who have looked carefully at the exact copy of the stamp will readily acknowledge that the monogram or nexus which had been explained as MV or MA is still more like AN, though that reading did not occur to interpreters who had no clue to the meaning, but to Dr. McCaul who had noticed the use of the title *Antoniniana* it would at once suggest itself, enabling him to overcome a great difficulty and to penetrate a mystery hitherto inexplicable.

Our limited space does not permit further extracts, but we cannot take leave of Mr. Lee and his very attractive and useful volume, without expressing the hope that the example set by the publication of illustrated catalogues of the local Museums in Newcastle-on-Tyne and Caerleon, may be followed in other towns where there are collections of ancient relics, such as York and Bath, each of which could supply not only ample materials for a valuable volume, but also highly qualified editors, as their respective antiquities have been successfully investigated by the Rev. John Kenrick and the Rev. H. Scarth.

W. H.

## SCIENTIFIC AND LITERARY NOTES.

### ON THE TRANSFORMATION OF ENTOZOA. BY P. J. VAN BENEDEN.

The following abstract taken from the "Annals and Magazine of Natural History," will fulfil our promise of laying before our readers the discussion arising out of a paper of MM. Pouchet and Verrier. This paper "called forth from Professor Van Beneden a letter, the chief points of which are as follow :—

"He first states that MM. Pouchet and Verrier are in error in supposing that he regarded *Cœnurus cerebralis* as the scolex of *Tænia serrata;* he has described the Tape-worm produced by *Cœnurus* as a distinct species, under the name of *T. cœnurus*, and that produced by the *Cysticercus pisiformis* of the Rabbit as *Tænia serrata.* He ascribes the doubts of MM. Pouchet and Verrier to their having failed to distinguish these two species of Tape-worms. He does not, however, attempt to explain the main point dwelt upon by the French authors, namely, the presence in the intestines of the dogs of a much larger number of Tape-worms than that of the heads of *Cœnurus*, but expresses a hope that, by the continuation of their experiments, those gentlemen themselves will be able to clear up the mystery.

"Referring to the failure of MM. Pouchet and Verrier in producing staggers in sheep by the administration of mature ova of *Tænia serrata*, he shows that in experiments made simultaneously at Louvain, Giessen, and Copenhagen, with ova obtained from a single dog which had been fed with *Cœnuri*, precisely the same phenomena were produced nearly after the same lapse of time. In all these cases the young sheep were attacked by staggers about the fifteenth day—the only difference being that, at Copenhagen, only two out of three sheep were affected. The failure of the French experimentalists is ascribed by M. Van Beneden to their having administered ova of *Tænia serrata* instead of those of *T. cœnurus*.

"M. Van Beneden also communicates to the Academy the results of an experiment just completed by M. Leuckart.

"For some years a second species of *Tænia* the *T. mediocanellato*, has been indicated in the subject, but its mode of introduction and the characters of its *Cysticercus* were unknown. M. Leuckart has administered ova of *Tænia mediocanellata* to calves, and in a short time found a development of *Cysticerci*, especially in the muscles, so abundant as to cause a sort of leprosy. The *Cysticercus*, while still in the cysts of the calf, presents all the distinctive characters of the adult *Tænia*. Thus Tape-worm is developed by the use of veal and beef; but it is a distinct species, which has always been confounded with *Tænia solium*. In the present state of science, it may be asserted that *Tænia solium* is introduced into the human body by pork; *T. mediocanellata* by veal and beef; and the *Bothriocephalus*, or Broad Tape-worm of the older writers (in Switzerland, Poland, and Russia), by water.*

"At the Meeting of the Academy of Sciences on the 16th of June, MM. Pouchet and Verrier replied to Prof. Van Beneden's remarks, asserting that they have not committed the error ascribed to them by him, as, if his *Tænia cœnurus* be really a distinct species, of which they express great doubts, it was this that they administered to their young sheep. They add that in a recent experiment, in which each of two dogs received a hundred heads of *Cœnurus cerebralis*, the examination of the intestines two months after the administration showed in one dog two specimens of *Tænia cucumerina*, 50 centimetres in length, and filled with ova, and in the other, two of *T. Serrata*, one 12 millimetres and the other 20 centimetres in length.—*Comptes Rendus*, June 2 and 16, pp. 1157 and 1207.

### SPONGIADÆ.

We perceive that Dr. Bowerbank has recently laid before the Royal Society his third paper "On the Anatomy and Physiology of the Spongiadæ." The scientific world has long looked to him for information on this curious and interesting, but hitherto neglected, branch of Natural History, upon which both his extensive collections (accumulated during many years) and his skill as a microscopic observer qualify him to throw new light, and which has been long known to have engaged his special attention. We are now at length made acquainted with his general views, and we are led to expect details respecting genera and species, in a promised work to be brought out by the Ray Society.

Dr. Bowerbank, rightly we think, prefers for the Sponges the name *Porifera*, introduced by Dr. Grant to De Blainville's name *Amorphozoa*. *Porifera*, with

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"* Dr. Koch, of St. Petersburg, has lately stated that the embryos of *Bothriocephalus latus* are covered with vibratile cilia, and that, in the form of Infusoria, they live free in the water. He adds this interesting remark, that in Moscow, where spring water is drunk, the *Bothriocephalus* is rare; whilst at St. Petersburg, Riga, and Dorpat, where river-water is used, it is very common."

*Rhizopoda* and *Infusoria*, are the classes of the sub-kingdom Protozoa. Dr. Grant proposed to divide *Porifera* into three orders, according to the material of which the skeleton is composed, whether horny, calcareous, or siliceous. This division furnishes to Dr Bowerbank the orders of his class, under the names of *Calcarea*, *Silicea*, and *Keratosa*. *Calcarea* is the smallest in numbers as well as the lowest in position of these orders: it includes only the Sponges which formed Fleming's genus *Grantia*, now divided by Bowerbank, according to the structure of the skeleton, into four genera. The second order *Silicea*, is far more extensive, and is divided according to the structure of the skeleton, into seven sections or sub-orders, several of which contain numerous genera. In these the skeleton is characterised as being either: 1. Spiculo radiate; 2. Spiculo membranous; 3. Spiculo-reticulate; 4 Spiculo-fibrous; 5. Compound-reticulate; 6. Siliceo-fibrous; or, 7. Canaliculated Siliceo-fibrous.

The third order, *Keratosa*, consisting of Sponges with horny skeletons, is likewise divided into seven sub-orders, accordingly as the skeleton is solid non-spiculate kerato-fibrous; solid semi spiculate kerato-fibrous; solid spiculate kerato-fibrous; simple fistulo-fibrous; compound fistulo-fibrous; regular semi-areno-fibrous; or irregular, entirely areno-fibrous.

Under these divisions, both the genera previously received and those established by himself are carefully characterised by Dr Bowerbank, in accordance with their anatomical structure. He has added a dissertation on the discrimination of species, with a review of the portions of the organisation that may be employed with advantage in their scientific determination, and directions for the examination and preservation of specimens.

Dr. Bowerbank's series of papers communicated to the Royal Society, supplies a desideratum in the literature of Natural History, and his further communications will be awaited with much interest. W. H.

## METEOROLOGY.

### MEAN RESULTS OF METEOROLOGICAL OBSERVATIONS AT HAMILTON, C. W., FOR THE YEAR 1861.

| | Thermometer. | | | | | Barometer. | | | Days. | | | Years. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Months. | Mean 9 A.M | Mean 9 P.M | M. of both. | Highest | Lowest. | Mean | Highest. | Lowest. | Rainy. | Slight Sh'r. | Dry. | Mean Temperature. |
| January. | 20.64° | 22.61° | 21.129° | 45° | -16° | 29.628 | 30.25 | 29.00 | 4 | 9 | 18 | 1849... 48.105° |
| Feb ...... | 28.00 | 29.10 | 28.550 | 60 | -16 | .550 | .02 | .08 | 6 | 7 | 15 | 1850......48.732 |
| March ... | 29.12 | 29.90 | 29.510 | 68 | - 4 | .608 | .10 | .10 | 5 | 10 | 16 | 1851......48.756 |
| April...... | 43.66 | 44.06 | 43.860 | 75 | 27 | .570 | .07 | .16 | 4 | 9 | 17 | 1852......48.218 |
| May ...... | 53.00 | 51.03 | 52.015 | 78 | 36 | .566 | 29.97 | 28.76 | 4 | 6 | 21 | 1853..... 49.474 |
| June..... | 68.53 | 66.03 | 67.280 | 90 | 45 | .625 | .80 | 29.30 | 1 | 5 | 24 | 1854 .....49.103 |
| July ...... | 72.35 | 71.00 | 71.679 | 93 | 42 | .632 | .88 | .33 | 1 | 5 | 25 | 1855 .....47.316 |
| August... | 70.25 | 69.90 | 70.080 | 98 | 53 | .714 | .92 | .48 | 4 | 7 | 20 | 1856......44.888 |
| Sept...... | 62.53 | 62.63 | 62.580 | 85 | 43 | .692 | 30.10 | .18 | 4 | 6 | 20 | 1857 .....45.868 |
| October.. | 50.51 | 51.61 | 51.060 | 75 | 30 | .648 | .05 | .02 | 3 | 8 | 20 | 1858 .....48.142 |
| Nov ...... | 38.43 | 39.00 | 38.710 | 62 | 26 | .505 | 29.92 | .10 | 1 | 7 | 22 | 1859 .... 46.996 |
| Dec......... | 31.90 | 35.80 | 33.850 | 62 | 11 | .736 | 30.16 | .22 | 2 | 5 | 24 | 1860 .....47.357 |
| Mean temp. of year......47.525 | | | | | | M. height 29.623 | | | 39 | 84 | 242 | |

# MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST—JUNE, 1862.

*Latitude—43 deg. 39.4 min. North. Longitude—5 h. 17 min. 33 sec. West. Elevation above Lake Ontario, 108 feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Re-sultant Direc-tion. | Velocity of Wind. | | | | | Rain in Inches. | Snow in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | MEAN. | 6 A.M | 2 P.M. | 10 PM | ME'N | | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M. | 2 P.M. | 10 P.M. | | 6 A.M | 2 P.M | 10 PM | Re-sul't. | ME'N | | |
| | | | | | ° | ° | ° | ° | ° | | | | | | | | | | | | ° | | | | | | | |
| 1 | 29.400 | 29.381 | — | — | 57.2 | 61.9 | — | — | — | .358 | .414 | — | — | .76 | .75 | — | — | N E b E | E b N | Calm. | N 82 E | 5.0 | 6.5 | 0.0 | 3.04 | 3.10 | ... | ... |
| 2 | .396 | .416 | 29.476 | 29.4335 | 50.8 | 59.8 | 55.8 | 56.28 | — 0.98 | .272 | .392 | .388 | .352 | .73 | .76 | .87 | .77 | Calm. | Calm. | Calm. | N | 0.0 | 0.0 | 0.0 | 2.27 | 3.29 | ... | ... |
| 3 | .594 | .680 | .737 | .6795 | 54.0 | 59.4 | 55.1 | 56.33 | — 1.22 | .335 | .358 | .353 | .343 | .80 | .70 | .82 | .76 | N b E | E S E | N N E | N 35 E | 5.0 | 2.8 | 3.8 | 4.23 | 4.81 | ... | ... |
| 4 | .757 | .769 | .783 | .7722 | 55.4 | 59.4 | 52.6 | 56.15 | — 1.70 | .172 | .232 | .310 | .244 | .39 | .45 | .78 | .55 | N E b N | E b S | N N E | N 56 E | 9.5 | 10.4 | 2.5 | 5.41 | 7.00 | ... | ... |
| 5 | .790 | .776 | .703 | .7548 | 54.7 | 69.9 | 55.9 | 60.95 | + 2.80 | .283 | .345 | .227 | .293 | .65 | .46 | .49 | .53 | N b E | S E b E | N E b E | S 86 E | 7.5 | 2.5 | 1.0 | 0.77 | 1.80 | ... | ... |
| 6 | .669 | .546 | .446 | .5495 | 49.3 | 68.8 | 57.2 | 60.92 | + 2.47 | .202 | .397 | .370 | .335 | .57 | .57 | .79 | .62 | Calm. | S E | N E | S 81 E | 0.0 | 4.0 | 2.5 | 1.07 | 2.16 | ... | ... |
| 7 | .454 | .572 | .618 | .5558 | 57.6 | 57.4 | 55.5 | 57.47 | — 1.28 | .331 | .384 | .294 | .322 | .69 | .81 | .66 | .67 | N E b E | S S E | N W bN | N 16 E | 6.0 | 0.5 | 5.5 | 3.61 | 5.52 | 0.005 | ... |
| 8 | .700 | .747 | — | — | 52.6 | 63.4 | — | — | — | .188 | .254 | — | — | .46 | .43 | — | — | N b E | S b W | Calm. | N 7 W | 9.2 | 6.2 | 0.0 | 1.61 | 3.93 | ... | ... |
| 9 | .816 | .777 | .751 | .7780 | 48.2 | 67.0 | 58.0 | 59.18 | — 0.30 | .245 | .274 | .250 | .260 | .72 | .41 | .51 | .52 | N W b W | S b W | W S W | S 34 W | 1.5 | 5.5 | 2.0 | 2.31 | 3.14 | ... | ... |
| 10 | .759 | .658 | .560 | .6523 | 50.8 | 75.6 | 56.9 | 61.58 | + 1.80 | .262 | .332 | .276 | .316 | .70 | .37 | .59 | .58 | Calm. | S | N E | S 1 E | 0.0 | 4.4 | 0.4 | 1.43 | 1.66 | ... | ... |
| 11 | .504 | .384 | .333 | .3948 | 55.1 | 69.9 | 56.5 | 61.17 | + 1.18 | .337 | .410 | .378 | .379 | .77 | .55 | .83 | .71 | Calm. | S b W | W S W | S 34 W | 0.0 | 3.6 | 0.5 | 2.44 | 2.87 | ... | ... |
| 12 | .306 | .267 | .377 | .3138 | 61.9 | 77.4 | 62.3 | 68.25 | + 7.98 | .402 | .471 | .434 | .461 | .73 | .49 | .77 | .67 | W b N | W | N W bN | N 72 W | 5.5 | 17.5 | 8.0 | 6.85 | 8.75 | 0.010 | ... |
| 13 | .419 | .452 | .490 | .4577 | 59.1 | 66.6 | 58.7 | 61.58 | + 1.00 | .402 | .466 | .231 | .365 | .80 | .71 | .46 | .64 | N W bN | S b W | N W b W | N 54 W | 12.0 | 7.6 | 8.0 | 4.87 | 6.42 | ... | ... |
| 14 | .563 | .564 | .586 | .5765 | 56.2 | 59.8 | 54.7 | 58.33 | — 2.50 | .232 | .369 | .304 | .310 | .51 | .72 | .71 | .63 | W | S E | W N W | N 41 E | 1.0 | 5.4 | 2.0 | 1.87 | 5.40 | 0.025 | ... |
| 15 | .715 | .787 | — | — | 53.6 | 62.7 | — | — | — | .206 | .096 | — | — | .49 | .16 | — | — | N N E | N | N | N 6 E | 7.5 | 17.0 | 8.0 | 8.77 | 9.82 | ... | ... |
| 16 | 30.109 | 30.020 | .845 | .9313 | 50.0 | 59.8 | 49.0 | 53.28 | — 8.07 | .243 | .193 | .253 | .231 | .67 | .37 | .73 | .58 | N E b E | E S E | E N E | S 88 E | 2.8 | 9.0 | 4.8 | 4.39 | 5.04 | ... | ... |
| 17 | 29.693 | 29.435 | .318 | .4627 | 52.9 | 71.7 | 60.9 | 62.85 | + 1.20 | .318 | .438 | .477 | .421 | .78 | .56 | .89 | .73 | E N E | S b W | S W bW | S 25 W | 2.0 | 15.0 | 8.0 | 8.37 | 9.20 | 0.037 | ... |
| 18 | .229 | .163 | .238 | .2142 | 60.1 | 63.0 | 55.4 | 59.90 | — 2.05 | .461 | .526 | .394 | .458 | .89 | .91 | .89 | .88 | S W | S W | N W bN | N 79 W | 9.0 | 8.8 | 10.0 | 2.24 | 8.78 | 0.650 | ... |
| 19 | .314 | .391 | .466 | .3938 | 49.3 | 56.3 | 51.8 | 52.10 | —10.03 | .323 | .316 | .209 | .286 | .91 | .70 | .53 | .72 | N | N W b N | N N W | N 38 W | 9.2 | 7.8 | 10.0 | 5.26 | 7.10 | 0.025 | ... |
| 20 | .512 | .492 | .529 | .5123 | 44.3 | 59.8 | 55.8 | 54.57 | — 7.88 | .221 | .292 | .412 | .316 | .76 | .56 | .93 | .74 | W b N | S S E | W b S | S 25 W | 4.5 | 9.6 | 3.2 | 4.18 | 5.33 | 0.112 | ... |
| 21 | .563 | .625 | .756 | .6587 | 53.3 | 67.7 | 52.6 | 58.05 | — 4.62 | .366 | .336 | .196 | .296 | .89 | .49 | .49 | .62 | N W b W | W N W | N N W | N 55 W | 5.0 | 16.0 | 21.6 | 8.74 | 10.69 | ... | ... |
| 22 | .878 | .853 | — | — | 48.6 | 63.4 | — | — | — | .249 | .344 | — | — | .72 | .59 | — | — | N W b W | S S W | N W | S 35 W | 6.2 | 8.8 | 2.0 | 1.41 | 4.83 | ... | ... |
| 23 | .773 | .698 | .616 | .6880 | 56.5 | 56.2 | 56.9 | 57.13 | — 6.02 | .341 | .417 | .396 | .387 | .74 | .93 | .85 | .83 | N E b E | E b N | E N E | N 68 E | 4.5 | 4.0 | 6.0 | 6.76 | 7.06 | 0.105 | ... |
| 24 | .590 | .572 | .606 | .5877 | 57.6 | 60.1 | 52.2 | 56.70 | — 6.65 | .376 | .448 | .337 | .386 | .79 | .86 | .86 | .84 | N E b E | E | N N W | N 37 E | 11.0 | 2.6 | 2.5 | 3.83 | 5.56 | 0.213 | ... |
| 25 | .651 | .658 | .636 | .6455 | 55.1 | 67.4 | 67.7 | 64.05 | + 0.50 | .386 | .430 | .287 | .371 | .89 | .64 | .41 | .63 | N W b W | S S W | N N W | N 46 W | 6.2 | 9.5 | 12.5 | 5.36 | 9.17 | ... | ... |
| 26 | .659 | .623 | .592 | .6232 | 65.2 | 83.2 | 68.1 | 73.32 | + 9.43 | .265 | .284 | .319 | .304 | .41 | .24 | .47 | .38 | N N W | N W bN | N W bN | N 38 W | 13.0 | 9.5 | 9.0 | 7.46 | 7.86 | ... | ... |
| 27 | .628 | .541 | .537 | .5670 | 63.7 | 78.9 | 66.6 | 70.52 | + 6.45 | .340 | .450 | .416 | .398 | .57 | .45 | .63 | .53 | W N W | S b W | N W b W | S 53 W | 2.0 | 9.2 | 8.0 | 4.17 | 6.57 | ... | ... |
| 28 | .553 | .508 | .461 | .5060 | 62.3 | 78.5 | 63.4 | 69.57 | + 5.28 | .408 | .400 | .420 | .415 | .72 | .40 | .71 | .59 | N W | S b E | S S W | S 71 E | 3.0 | 4.5 | 0.5 | 1.45 | 3.21 | ... | ... |
| 29 | .407 | .341 | — | — | 65.2 | 74.2 | — | — | — | .498 | .643 | — | — | .79 | .77 | — | — | E | E b S | N N W | N 19 W | 5.4 | 1.0 | 6.0 | 2.36 | 3.99 | 0.025 | ... |
| 30 | .267 | .316 | .434 | .3473 | 62.7 | 70.6 | 53.6 | 62.85 | — 1.73 | .478 | .492 | .276 | .393 | .84 | .66 | .67 | .67 | N W bN | N W bN | N W | N 34 W | 11.0 | 24.6 | 9.0 | 14.99 | 15.29 | ... | ... |
| ... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ... | ... | ... | ... | ... | ... | ... | ... | ........... | ........... | ........... | ........... | ...... | ...... | ...... | ...... | ...... | ... | ... |
| M | 29.5827 | 29.5561 | 29.5558 | 29.5642 | 55.44 | 66.57 | 57.33 | 60.52 | — 0.51 | .320 | .378 | .328 | .346 | .72 | .59 | .69 | .66 | ........... | ........... | ........... | ........... | 5.48 | 7.79 | 5.24 | ...... | 5.98 | 1.007 | ...... |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JUNE, 1862.

Highest Barometer........................ 30.109 at 6 a. m. on 16th } Monthly range =
Lowest Barometer ........................ 29.163 at 2 p. m. on 18th } 0.946 inches.

Self-regist'ing Thermom. { Maximum Temperature ............... 85°4 on p.m. of 26th } Monthly range =
Minimum Temperature ............... 39°4 on a.m. of 9th } 46°0
Mean maximum Temperature ..................... 69°12 } Mean daily range =
Mean minimum Temperature ..................... 50°97 } 18°14
Greatest daily range ........... 31°8 from a. m. to p.m. of 17th.
Least daily range.................. 6°2 from a. m. to p. m. of 24th.

Warmest day......... 26th... Mean temperature......... 73°32 } Difference = 21°22.
Coldest day......... .. 19th... Mean temperature......... 52°10 }
Maximum { Solar...................................... 102°0 on 26th } Monthly range =
Radiation. { Terrestrial ................................. 30°8 on 9th } 71°2

Aurora observed on 2 nights, viz.,—13th and 19th.
Possible to see Aurora on 17 nights; impossible on 13 nights.
Snowing on 0 days, depth ... inches; duration of fall, ... hours.
Raining on 10 days,—depth 1.007 inches; duration of fall 26.1 hours.
Mean of cloudiness = 0.60. Below average 0.07.
Most cloudy hour observed, 2 p. m., mean = 0.74; least cloudy hour observed, 10 p. m.; mean, = 0.42.

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*Sums of the components of the Atmospheric Current, expressed in miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 2154.74 | 1016.45 | 876.41 | 1443.92 |

Resultant direction N. 26° W.; Resultant velocity 1.77 miles per hour.
Mean velocity ............................5.98 miles per hour.
Maximum velocity ..................... 26.4 miles, from 1 to 2 p. m. on 30th.
Most windy day ......30th ............Mean velocity, 15.29 miles per hour. } Difference =
Least windy day......10th ............Mean velocity, 1.66 ditto. } 13.63 miles.
Most windy hour ...11 a.m. to noon.........Mean velocity, 8.30 ditto. } Difference =
Least windy hour...5 p. m. to 6 p.m..........Mean velocity 4.54 ditto. } 3.76 miles.

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7th. Ground fog 6 to 8 a.m; thunderstorm 7 to 10 a. m.—11th. Total eclipse of the moon; night very favourable for observation.—14th. Fire-flies first observed at 10 p. m.—17th. Solar halo from 7 a. m. till 2 p. m.—18th. Thunderstorm 4 to 8 p.m.; imperfect rainbow at 7 p. m.—19th. Ground fog at 6 a. m.—20th. Hoar frost at 5 30 a. m. (latest of the season); thunderstorm 8 to 10.10 p.m.—29th. Fog at 9 p. m.

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A considerable quantity of pollen of plants fell with the rain during the thunderstorm on the 18th inst.

Heavy Dew recorded on 3 mornings during the month.

June, 1862, was cold and extremely dry; the amount of rain recorded only amounted to one-third of the average depth; it was absolutely the driest June during the last 23 years.

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### COMPARATIVE TABLE FOR JUNE.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | Diff. above ave'ge | Max. ob-served. | Min. ob-served. | Range. | No. of days. | Inches | No. of days. | Inches | Resultant. Direction. | Resultant. V'y. | Mean Force or Velocity. |
| 1840 | °59.8 | — °1.6 | °78.5 | °37.1 | °41.4 | 11 | 4.860 | 0 | ... | ... | ... | ............ |
| 1841 | 65.6 | + 4.2 | 92.8 | 45.7 | 47.1 | 9 | 1.560 | 0 | ... | ... | ... | 0.36 lbs. |
| 1842 | 55.6 | — 5.8 | 73.9 | 28.0 | 45.9 | 15 | 5.755 | 0 | ... | ... | ... | 0.31 |
| 1843 | 58.4 | — 3.0 | 81.3 | 28.5 | 52.8 | 12 | 4.595 | 0 | ... | ... | ... | 0.27 |
| 1844 | 59.9 | — 1.5 | 82.8 | 33.1 | 49.7 | 9 | 3.535 | 0 | ... | ... | ... | 0.19 |
| 1845 | 61.0 | — 0.4 | 83.6 | 40.9 | 42 7 | 11 | 3.715 | 0 | ... | ... | ... | 0.27 |
| 1846 | 63.3 | + 1.9 | 83.3 | 41.5 | 41.8 | 10 | 1.920 | 0 | ... | ... | ... | 0.32 |
| 1847 | 58.4 | — 3.0 | 73.3 | 36.7 | 41.6 | 14 | 2.625 | 0 | ... | ... | ... | 0.30 |
| 1848 | 62.9 | + 1.5 | 92 5 | 38.3 | 54.2 | 8 | 1.810 | 0 | ... | N 61° W | 1.90 | 4.51mls. |
| 1849 | 63.2 | + 1.8 | 84.9 | 45.2 | 39.7 | 7 | 2.020 | 0 | ... | S 71° E | 0.49 | 3.32 |
| 1850 | 64.3 | + 2.9 | 83.2 | 49.0 | 34.2 | 10 | 3.345 | 0 | ... | S 60° W | 0.38 | 4.51 |
| 1851 | 59.2 | — 2.2 | 79.2 | 41.2 | 38.0 | 11 | 2.695 | 0 | ... | S 2° W | 1.26 | 4.42 |
| 1852 | 60.8 | — 0.6 | 86.1 | 43.6 | 42.5 | 10 | 3 160 | 0 | ... | S 76° W | 1.49 | 4.09 |
| 1853 | 65.5 | + 4.1 | 86.3 | 43.3 | 43.0 | 9 | 1.550 | 0 | ... | N 1° W | 0.10 | 3.73 |
| 1854 | 64.1 | + 2 7 | 88.7 | 47.4 | 41.3 | 9 | 1.460 | 0 | ... | N 24° E | 0.71 | 4.15 |
| 1855 | 59.9 | — 1.5 | 90.7 | 40.6 | 50.1 | 17 | 4.070 | 0 | ... | N 69° W | 1.33 | 5.70 |
| 1856 | 62.1 | + 0.7 | 82.6 | 48.3 | 34.3 | 13 | 3.200 | 0 | ... | S 21° W | 0.90 | 5.30 |
| 1857 | 56.9 | — 4.5 | 75.1 | 40.9 | 34.2 | 21 | 5.060 | 0 | ... | N 49° W | 1.15 | 7.60 |
| 1858 | 66.2 | + 4.8 | 86.3 | 48.7 | 37.6 | 12 | 2.943 | 0 | ... | S 20° E | 0.25 | 5.53 |
| 1859 | 58.3 | — 3.1 | 85.2 | 33.9 | 51.3 | 16 | 4.085 | 2 | Inap | N 77° W | 1.95 | 7.19 |
| 1860 | 63.2 | + 1.8 | 81.1 | 50.0 | 31.1 | 14 | 2.136 | 0 | ... | N 44° W | 3.13 | 7.61 |
| 1861 | 61.3 | — 0.1 | 86.5 | 48.2 | 38.3 | 13 | 2.329 | 0 | ... | N 39° W | 2.29 | 6.11 |
| 1862 | 60.5 | — 0 9 | 83.2 | 44.3 | 38.9 | 10 | 1.007 | 0 | ... | N 26° W | 1.77 | 5.98 |
| Results to 1861. | 61.36 | ... | 83.77 | 41.37 | 42.40 | 11.9 | 3 100 | ... | ... | N 69° W | 0.81 | 5.27 |
| Diff. for 1862. | — 0.84 | ... | — 0.57 | +2.93 | — 3.50 | — 1.9 | — 2.093 | ... | ... | ......... | ...... | + 0.71 |

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—JULY, 1862.

*Latitude*—43 *deg.* 39.4 *min. North. Longitude*—5 *h.* 17 *m.* 33 *s. West. Elevation above Lake Ontario,* 108 *feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resul't. Direction. | Velocity of Wind. | | | | | Rain in inches. | Snow in inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | Mean. | 6 A.M | 2 P.M | 10 PM | ME'N | | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A. M. | 2 P. M. | 10 P. M. | | 6 AM. | 2 PM. | 10 P.M. | Re-sul't. | ME'N | | |
| 1 | 29.445 | 29.387 | 29.398 | 29.4093 | 52.6 | 68.4 | 56.9 | 60.53 | — 4.23 | .289 | .315 | .297 | .301 | .73 | .45 | .64 | .58 | N | s b E | W | s 10 W | 7.0 | 12.2 | 1.2 | 4.65 | 5.66 | ... | ... |
| 2 | .432 | .490 | .555 | .4982 | 56.3 | 68.1 | 56.5 | 61.47 | — 3.53 | .359 | .295 | .281 | .326 | .79 | .42 | .61 | .60 | E b N | E S E | N E | s 76 E | 2.4 | 7.5 | 0.5 | 2.97 | 3.33 | ... | ... |
| 3 | .690 | .769 | .826 | .7753 | 58.7 | 76.4 | 61.9 | 65.60 | + 0.45 | .350 | 525 | .477 | .461 | .71 | .57 | .86 | .74 | Calm. | s b E | E S E | s 51 E | 0.0 | 4.8 | 1.2 | 1.86 | 2.83 | ... | ... |
| 4 | .931 | .865 | .835 | .8750 | 60.1 | 82.5 | 69.2 | 72.22 | + 6.92 | .448 | .595 | .551 | .548 | .86 | .53 | .77 | .70 | Calm. | s b E | s W | s 12 W | 0.0 | 9.5 | 1.0 | 3.53 | 3.97 | ... | ... |
| 5 | .842 | .742 | .675 | .7468 | 66.3 | 88.6 | 74.9 | 77.58 | +12.20 | .535 | .658 | .588 | .598 | .83 | .49 | .67 | .64 | Calm. | s s W | W b s | s 41 W | 0.0 | 11.2 | 8.4 | 6.42 | 6.88 | ... | ... |
| 6 | .647 | .574 | — | — | 75.7 | 86.8 | — | — | — | .547 | .734 | — | — | .62 | .57 | — | — | W b s | s b E | NW b N | N 62 W | 1.5 | 9.8 | 7.0 | 6.51 | 9.43 | ... | ... |
| 7 | .540 | .446 | .353 | .4310 | 63.7 | 79.2 | 65.9 | 71.42 | + 5.72 | .465 | .561 | .325 | .447 | .78 | .56 | .50 | .58 | N W | s W | W N W | s 72 W | 2.5 | 4.2 | 4.0 | 2.35 | 3.02 | ... | ... |
| 8 | .369 | .342 | .322 | .3425 | 68.1 | 81.8 | 68.4 | 73.67 | + 7.88 | .511 | .607 | .534 | .557 | .75 | .56 | .77 | .68 | s W | s | s s E | s 7 W | 4.5 | 7.0 | 1.5 | 2.13 | 3.36 | 0.320 | ... |
| 9 | .206 | .296 | .446 | .3195 | 65.9 | 76.7 | 64.8 | 69.63 | + 3.65 | .581 | .495 | .400 | .488 | .91 | .53 | .65 | .69 | N E b N | N N W | NW b W | N 28 W | 3.0 | 15.0 | 8.8 | 8.23 | 8.45 | 0.047 | ... |
| 10 | .578 | .635 | .676 | .6355 | 58.7 | 74.6 | 61.2 | 65.55 | — 0.53 | .339 | .221 | .328 | .300 | .68 | .25 | .61 | .51 | N | N N W | W N W | N 19 W | 6.2 | 12.8 | 7.0 | 7.75 | 8.03 | ... | ... |
| 11 | .740 | .695 | .607 | .6705 | 52.9 | 73.8 | 57.6 | 63.32 | — 2.87 | .327 | .423 | .399 | .390 | .82 | .50 | .84 | .68 | NW b W | s b E | s b E | s 17 W | 1.2 | 7.0 | 0.5 | 1.66 | 3.08 | ... | ... |
| 12 | .548 | .427 | .349 | .4327 | 57.2 | 83.9 | 70.2 | 70.77 | + 4.47 | .404 | .529 | .497 | .473 | .86 | .45 | .67 | .64 | W b N | W | W | s 67 W | 1.5 | 18.0 | 4.5 | 6.62 | 7.25 | Inp. | ... |
| 13 | .286 | .241 | — | — | 66.6 | 77.1 | — | — | — | .505 | .591 | — | — | .77 | .63 | — | — | s W | s W b s | W | s 56 W | 10.0 | 14.0 | 10.0 | 7.55 | 8.38 | 0.625 | ... |
| 14 | .362 | .445 | .507 | .4433 | 62.7 | 72.0 | 60.9 | 64.78 | — 1.63 | .517 | .598 | .441 | .512 | .90 | .76 | .82 | .83 | W s W | s b E | E N E | N 89 E | 2.0 | 5.4 | 4.6 | 3.48 | 5.16 | Inp. | ... |
| 15 | .491 | .423 | .469 | .4662 | 60.9 | 64.1 | 62.3 | 64.28 | — 2.20 | .503 | .538 | .522 | .553 | .94 | .90 | .93 | .92 | E b N | N E b N | s s W | N 44 E | 8.0 | 4.0 | 1.0 | 2.80 | 5.32 | 0.140 | ... |
| 16 | .532 | .583 | .650 | .5987 | 63.7 | 68.8 | 57.3 | 63.32 | — 3.27 | .491 | .426 | .368 | .424 | .83 | .62 | .78 | .73 | N W b N | N N W | N N W | N 26 W | 8.0 | 11.8 | 7.5 | 7.13 | 8.30 | ... | ... |
| 17 | .675 | .708 | .716 | .6982 | 55.8 | 67.4 | 60.1 | 61.52 | — 5.17 | .333 | .442 | .436 | .389 | .74 | .66 | .84 | .71 | N b E | s b W | E N E | N 86 E | 9.4 | 8.0 | 4.4 | 2.71 | 6.10 | ... | ... |
| 18 | .723 | .715 | .704 | .7153 | 59.8 | 67.0 | 62.3 | 63.82 | — 2.87 | .392 | .447 | .410 | .429 | .76 | .67 | .73 | .72 | N E | E b N | E b N | N 81 E | 7.0 | 12.2 | 7.0 | 8.37 | 8.47 | ... | ... |
| 19 | .678 | .551 | .419 | .5333 | 64.8 | 68.1 | 65.2 | 66.70 | — 0.03 | .489 | .551 | .590 | .565 | .79 | .80 | .95 | .86 | E b s | E b s | N E b E | s 80 E | 4.5 | 6.2 | 2.2 | 4.73 | 5.29 | 1.335 | ... |
| 20 | .333 | .312 | — | — | 67.0 | 72.4 | — | — | — | .636 | .701 | — | — | .97 | .88 | — | — | s | N b E | NW b W | N 77 W | 5.0 | 5.4 | 6.0 | 6.69 | 8.13 | 0.290 | ... |
| 21 | .444 | .482 | .553 | .4995 | 62.3 | 66.6 | 63.4 | 64.23 | — 2.53 | .536 | .545 | .560 | .545 | .95 | .83 | .96 | .91 | W b N | s b W | Calm. | N 6 E | 3.3 | 0.5 | 0.0 | 0.33 | 1.37 | 0.005 | ... |
| 22 | .579 | .559 | .503 | .5448 | 64.1 | 70.6 | 66.6 | 67.35 | + 0.48 | .551 | .603 | .572 | .569 | .92 | .81 | .88 | .85 | Calm. | E S E | E S E | s 42 E | 0.0 | 7.6 | 1.4 | 4.18 | 5.07 | 0.352 | ... |
| 23 | .321 | .247 | .367 | .3102 | 66.6 | 79.6 | 65.9 | 70.23 | + 3 35 | .614 | .484 | .450 | .510 | .93 | .47 | .70 | .71 | s | W N W | NW b N | N 76 W | 5.2 | 18.0 | 5.2 | 5.72 | 7.56 | 0.880 | ... |
| 24 | .395 | .368 | .459 | .4090 | 61.9 | 65.9 | 58.0 | 63.27 | — 3.60 | .477 | .567 | .370 | .473 | .86 | .89 | .77 | .81 | N W b N | NW b N | W b N | s 83 W | 1.0 | 3.0 | 4.5 | 4.94 | 5.95 | 0.090 | ... |
| 25 | .489 | .493 | .499 | .4977 | 56.5 | 70.2 | 60.5 | 62.67 | — 4.30 | .368 | .418 | .395 | .384 | .80 | .57 | .74 | .68 | W b s | s b W | NW b W | s 71 W | 5.2 | 9 0 | 4.0 | 4.40 | 6.60 | 0.005 | ... |
| 26 | .544 | .544 | .610 | .5672 | 60.1 | 74.6 | 63.4 | 66.57 | — 0.40 | .425 | .373 | .403 | .411 | .81 | .43 | .69 | .65 | W b s | W N W | N | N 72 W | 3.5 | 13.8 | 6.2 | 3.98 | 6.86 | ... | ... |
| 27 | .682 | .643 | — | — | 59.1 | 73.1 | — | — | — | .356 | .404 | — | — | .71 | .49 | — | — | N W | S E b S | S W b W | s 7 W | 1.0 | 8.4 | 0.5 | 2.76 | 3 75 | ... | ... |
| 28 | .582 | .548 | .481 | .5280 | 63.0 | 66.6 | 60.9 | 64.75 | — 2.22 | .450 | .599 | .516 | .532 | .78 | .92 | .96 | .87 | s W b s | s s W | W | s 34 W | 1.5 | 6.5 | 2.6 | 4.00 | 5.18 | 0.815 | ... |
| 29 | .469 | .496 | .526 | .5020 | 62.7 | 69.5 | 65.9 | 66.93 | — 0.02 | .530 | .603 | .514 | .551 | .92 | .84 | .80 | .83 | s W b s | S E b S | N b W | s 56 W | 5.0 | 6.0 | 3.2 | 1.95 | 4.47 | 0.440 | ... |
| 30 | .591 | .617 | .656 | .6283 | 65.2 | 73.5 | 65.5 | 68.48 | + 1.53 | .497 | .521 | .454 | .489 | .80 | .63 | .72 | .71 | W b N | N N W | N N W | N 38 W | 3.8 | 14.5 | 6.5 | 7.52 | 8.18 | ... | ... |
| 31 | .714 | .702 | .676 | .7012 | 65.2 | 74.6 | 67.7 | 70.25 | + 3.30 | .497 | .579 | .515 | .534 | .79 | .67 | .77 | .72 | N | s s W | N W b N | s 87 W | 11.2 | 5.5 | 4.0 | 0.91 | 4.43 | ... | ... |
| M | 29.5522 | 29.5398 | 29.5495 | 29.5474 | 61.33 | 73.08 | 63.46 | 66.70 | + 0.45 | .455 | .501 | .452 | .473 | .82 | .62 | .76 | .72 | ......... | ......... | ......... | ......... | 4.01 | 8.99 | 4.08 | ...... | 5.80 | 5.344 | ...... |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR JULY, 1862.

Highest Barometer . . . . . . . 29.957 at 8 a. m. on 4th. } Monthly range=
Lowest Barometer . . . . . . . 29.196 at 8 a. m. on 9th. } 0.761 inches.

Self-registering Ther.
- Maximum temperature . . . , 95°5 on p.m. of 6th } Monthly range=
- Minimum temperature . . . . 48°2 on a.m. of 11th } 47°3
- Mean maximum temperature . . 76°42 } Mean daily range=18°28
- Mean minimum temperature . . 58°14 }
- Greatest daily range . . . . . . . 31°9 from a. m. to p. m. of 12th.
- Least daily range . . . . . . . . 5.8 from a. m. to p. m. of 21st.

Warmest day . . . . 5th ...Mean Temperature . . .=77°58 } Difference=17°05.
Coldest day . . . . . 1st ...Mean Temperature . . .=60°53 }
Maximum { Solar . . . . . . . . . . 110°2 on p.m of 6th } Monthly range=
Radiation { Terrestrial . . . . . . . 39°5 on a. m. of 11th } 70°.7

Aurora observed on 6 nights, viz.: 5th, 9th, 17th, 23rd, 24th, and 31st; Possible to see Aurora on 20 nights; Impossible on 11 nights.

Raining on 15 days; depth, 5.344 inches; duration of fall, 35.4 hours.

Mean of cloudiness=0.56; above the average, 0.10. Most cloudy hour observed, 2 p.m.; mean=0.72; least cloudy hour observed, 10 p.m.; mean=0.42.

*Sums of the components of the Atmospheric Current, expressed in Miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 1410.01 | 1425.35 | 808.39 | 1861.52 |

Resultant direction, S. 89° W.; Resultant Velocity, 1.42 miles per hour.
Mean velocity 5.80 miles per hour.
Maximum velocity 19.6 miles, from 4 to 5 p.m. on the 20th.
Most windy day 6th—Mean velocity 9.43 miles per hour.
Least windy day 21st—Mean velocity 1.37 miles per hour.
Most windy hour, 4 to 5 p.m.—Mean velocity, 9.49 miles per hour. } Difference
Least windy hour, 4 to 5 a.m.—Mean velocity, 3.15 miles per hour. } 6.34 miles.

4th. Low ground fog at 6 a.m.—6th. Sudden burst of heat from 2 to 2.30 p.m.; temperature rising from 86°8 at 2 p.m. to 94°8 at 2 30 p.m.—9th. Thunderstorm, vivid lightning, and heavy rain from 4 to 6 a.m.; dense fog at 6 a.m.—13th. Severe thunderstorm from 9 p m. to 1 a.m. of 14th.—15th. Dense fog 6 a.m.; thunderstorm 6 to 8 a.m.—19th. Thunderstorm 5.15 to 8 p.m.; perfect rainbow 6 to 7 p.m. —23rd. Severe thunderstorm 6.30 to 7.30 a.m.; sheet lightning at night.—24th. Thunderstorm noon to 1 p.m.—25th. Sheet lightning in W. at 9 and 10 p.m.—27th. Sheet lightning in W. at 10 p.m.—28th. Heavy thunderstorm 7 to 8 p.m.—29th. Thunderstorm noon to 1.20 p.m.; sheet lightning 9 p.m. to midnight.

*Great Thermometric Ranges:*

| | |
|---|---|
| 6th p.m., 95°5 | 12th p.m., 83°5 |
| 7th a.m., 61°4 | 13th a.m., 52°0 |
| **Range in 14 hours ............ 34°1** | **Range in 18 hours ............ 31°5** |

July, 1862, was extremely wet, having been only once surpassed in 23 years, viz., 1841, when the depth recorded amounted to 8.150 inches.

### COMPARATIVE TABLE FOR JULY.

| | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR. | Mean. | Excess above Average, (66°8). | Maximum observed. | Minimum observed. | Range. | No. of days. | Inches. | No. of days. | Inches. | Resultant. | | Mean |
| | | | | | | | | | | Direction. | Velocity. | Velocity |
| 1840 | 65.8 | — 1.0 | 79.4 | 48.2 | 31.2 | 6 | 5.270 | ... | ... | ... | ... | ... |
| 1841 | 65.0 | — 1.8 | 86.3 | 43.2 | 43.1 | 10 | 8.150 | ... | ... | ... | ... | 0.27lbs |
| 1842 | 64.7 | — 2.1 | 90.5 | 42.0 | 48.5 | 4 | 3.050 | ... | ... | .. | ... | 0.33 " |
| 1843 | 64.5 | — 2.3 | 86.1 | 40.2 | 45.9 | 8 | 4.605 | ... | ... | ... | ... | 0.44 " |
| 1844 | 66.0 | — 0.8 | 86.1 | 40.5 | 45.6 | 12 | 2.815 | ... | ... | ... | ... | 0.19 " |
| 1845 | 66.2 | — 0.6 | 94.6 | 45.6 | 49.0 | 7 | 2.195 | .. | ... | ... | ... | 0.30 " |
| 1846 | 68.0 | + 1.2 | 94.0 | 44.9 | 49.1 | 9 | 2.895 | ... | ... | ... | ... | 0.29 " |
| 1847 | 68.0 | + 1.2 | 87.5 | 43.8 | 43.7 | 8 | 3.355 | ... | ... | ... | ... | 0.19 " |
| 1848 | 65.5 | — 1.3 | 82.7 | 46.7 | 36.0 | 10 | 1.890 | ... | ... | N 14 W | 0.18 | 4.94ms. |
| 1849 | 68.4 | + 1.6 | 89.1 | 51.0 | 38.1 | 4 | 3.415 | ... | ... | S 5 W | 0.75 | 3.52 " |
| 1850 | 68.9 | + 2.1 | 84.9 | 52.8 | 32.1 | 12 | 5.270 | ... | ... | N 81 E | 0.59 | 4.56 " |
| 1851 | 65.0 | — 1.8 | 82.7 | 52.1 | 30.6 | 12 | 3.625 | ... | ... | N 60 W | 0.88 | 4.13 " |
| 1852 | 66.8 | 0.0 | 90.1 | 49.5 | 40.6 | 8 | 4.025 | ... | ... | N 43 W | 0.93 | 3.33 " |
| 1853 | 65.6 | — 1.2 | 85.4 | 49.4 | 36.0 | 10 | 0.915 | ... | ... | S 58 E | 0.21 | 3.69 " |
| 1854 | 72.5 | + 5.7 | 93.6 | 53.0 | 40.6 | 9 | 4.805 | ... | ... | S 49 W | 0.37 | 4.03 " |
| 1855 | 67.9 | + 1.1 | 88.4 | 53.1 | 35.3 | 13 | 3.245 | ... | ... | S 19 W | 0.73 | 6.47 " |
| 1856 | 69.9 | + 3.1 | 92.0 | 51.4 | 40.6 | 8 | 1.120 | ... | ... | N 79 W | 1.57 | 5.84 " |
| 1857 | 67.8 | + 1.0 | 85.4 | 52.4 | 33.0 | 15 | 3.475 | ... | ... | S 68 E | 0.81 | 4.74 " |
| 1858 | 67.9 | + 1.1 | 83.4 | 55.9 | 27.5 | 13 | 3.072 | ... | ... | N 15 E | 1.13 | 5.76 " |
| 1859 | 66.9 | + 0.1 | 87.7 | 50.5 | 37.2 | 12 | 2.611 | ... | ... | N 56 W | 1.48 | 5.81 " |
| 1860 | 63.9 | — 2.9 | 85.8 | 47.5 | 38.3 | 13 | 4.336 | ... | ... | N 60 W | 2.15 | 7.29 " |
| 1861 | 65.4 | — 1.4 | 82.9 | 49.4 | 33.5 | 16 | 2.635 | ... | ... | N 74 W | 1.43 | 4.66 " |
| 1862 | 66.7 | — 0.1 | 88.6 | 52.6 | 36.0 | 15 | 5.344 | ... | ... | S 89 W | 1.42 | 5.80 " |
| Results to 1861. | 66.85 | ... | 87.21 | 48.32 | 38.89 | 10.0 | 3.490 | ... | ... | N 65 W | 0.49 | 4.91 |
| Diff. for 1862. | —0.15 | ... | + 1.39 | + 4.28 | — 2.89 | + 5.0 | + 1.854 | ... | ... | ... | ... | +0.89 |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—JUNE, 1862.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M. D., LL.D.

*Latitude*—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. (tenths) | Rain in Inches. | Snow in Inches. | Weather, &c. A cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 P.M. | 6 A.M. | 2 P.M. | 10 PM | 6 A.M. | 2 P.M. | 10 P.M. | | | | | 6 A.M. | 2 P.M. | 10 P.M. |
| 1 | 29.682 | 29.539 | 29.583 | 50.1 | 83.2 | 60.5 | .277 | .846 | .367 | .75 | .75 | .71 | S | SSW | SSE | 17.80 | 1.5 | ... | ... | Clear. | C. C. Str. 4. | Clear. |
| 2 | 608 | 516 | 608 | 44.0 | 83.6 | 65.0 | .218 | .884 | .488 | .76 | .77 | .75 | SSE | SSW | SSE | 0.00 | 1.5 | ... | ... | Cu. Str. 10. | Hazy. | Hazy. |
| 3 | 664 | 810 | 930 | 58.4 | 76.0 | 62.1 | .372 | .551 | .406 | .78 | .75 | .74 | NNE | NE | SbW | 3.90 | 1.5 | ... | ... | Clear. | C. C. Str. 8. | C. Cum. 6. |
| 4 | 974 | 30.085 | 960 | 50.0 | 72.2 | 55.7 | .265 | .273 | .295 | .75 | .35 | .68 | NEbE | SSE | S | 16.11 | 1.0 | ... | ... | Cirr. Str. 4. | C.C.Str.4.Im. | C. C. Str. 8. |
| 5 | 982 | 29.855 | 855 | 58.0 | 85.8 | 66.0 | .365 | .450 | .383 | .76 | .37 | .61 | SSW | SW | SWbS | 15.00 | 2.0 | ... | ... | Clear. | Clear. [S.H. | Hazy. |
| 6 | 777 | 723 | 746 | 52.2 | 84.2 | 56.2 | .282 | .584 | .363 | .73 | .50 | .81 | NEbE | SEbE | NEbE | 24.10 | 1.5 | ... | ... | Hazy. | Hazy. | Cirr.2.Lu.Cor. |
| 7 | 693 | 714 | 796 | 44.6 | 62.4 | 53.4 | .189 | .319 | .269 | .64 | .58 | .67 | NEbE | NEbE | NEbE | 125.20 | 1.5 | In'p. | ... | Cu. Str. 10. | Cl'r.Slt.Sh'rs. | C. C. Str. 4. |
| 8 | 862 | 898 | 954 | 52.5 | 72.1 | 55.0 | .232 | .303 | .269 | .60 | .39 | .62 | NEbE | NEbE | S | 158.60 | 1.5 | ... | ... | Cirr. 2. | Cirr. 2. | Clear. |
| 9 | 891 | 864 | 861 | 56.1 | 77.8 | 63.6 | .269 | .285 | .409 | .62 | .30 | .70 | SSW | W | WSW | 212.46 | 2.0 | ... | ... | Cl'ar. Lt. fr'st. | Clear. | Hazy. |
| 10 | 872 | 796 | 765 | 58.4 | 83.5 | 67.8 | .358 | .552 | .400 | .73 | .48 | .61 | SW | SW | SW | 79.00 | 2.0 | ... | ... | Hazy. | Hazy. | Do, |
| 11 | 574 | 497 | 465 | 56.1 | 93.1 | 70.1 | .262 | .800 | .557 | .59 | 52 | .77 | SW | SW | SW | 14.00 | 2.0 | ... | ... | Clear. | Do. | Do. |
| 12 | 347 | 307 | 445 | 57.4 | 82.5 | 65.0 | .295 | .578 | .549 | .63 | .54 | .89 | WbS | W | NE | 226.80 | 2.5 | 0.553 | ... | Do. | Do. | Clear. Moon |
| 13 | 593 | 516 | 585 | 62.7 | 82.1 | 65.0 | .485 | .578 | .549 | .86 | .54 | .89 | NW | SbW | WSW | 97.10 | 1.5 | ... | ... | Do. | C.Cirr.4.S.H. | Do. [eclipsed. |
| 14 | 673 | 714 | 727 | 50.0 | 64.7 | 55.8 | .309 | .396 | .355 | .85 | .65 | .84 | NEbE | NEbE | NWbW | 70.90 | 1.5 | ... | ... | Do. | Cu. Str. 4. | C. Cirr. 2. |
| 15 | 733 | 872 | 983 | 42.2 | 53.2 | 40.1 | .222 | .219 | .203 | .83 | .54 | .82 | NNW | N | WSW | 188.40 | 1.5 | ... | ... | Do. | Cirr. Cum. 4. | Clear. |
| 16 | 30.144 | 30.070 | 30.070 | 44.6 | 71.1 | 46.1 | .211 | .316 | .238 | .72 | .42 | .77 | SW | WSW | SSW | 96.30 | 1.5 | ... | ... | Do. Lt. fr'st. | Clear. | Do. |
| 17 | 29.935 | 29.714 | 29.714 | 52.1 | 84.0 | 71.0 | .302 | .590 | .476 | .82 | .51 | .64 | SSW | SSW | SSW | 157.74 | 1.5 | ... | ... | Cu. Cirr. 4. | C. Cirr. 4. | Cu.Str.4. Dist. |
| 18 | 341 | 324 | 344 | 61.5 | 77.0 | 60.1 | .406 | .639 | .462 | .74 | .69 | .91 | SW | SSW | NNE | 225.80 | 3.0 | 0.104 | ... | C. C. Str. 4. | C. C. Str. 10. | Rain. [l'tning. |
| 19 | 482 | 483 | 587 | 51.1 | 64.4 | 56.0 | .321 | .403 | .398 | .86 | .67 | .90 | NNE | NNE | SbE | 152.90 | 3.0 | 0.104 | ... | Cu. Str. 8. | C. Cu. 4. | C. C. 8. |
| 20 | 657 | 534 | 762 | 52.0 | 77.2 | 57.3 | .334 | .678 | .410 | 86 | .73 | .88 | SSW | SW | SbW | 58.70 | 2.5 | 0.042 | ... | C. Cu. 4. | Do. 2. | C. C. Str. 10. |
| 21 | 730 | 700 | 792 | 47.2 | 76.7 | 56.2 | .280 | .646 | .398 | .88 | .71 | .90 | SE | W | W | 115.60 | 3.0 | In'p | ... | Rain. | Cu. Cir. 4. | C.Str.4.Dis.th. |
| 22 | 891 | 898 | 876 | 52.2 | 71.9 | 56.7 | .334 | .403 | .357 | .86 | .54 | .78 | W | WSW | WSW | 230.70 | 2.5 | ... | ... | Clear. | C. C. 4. | Do. 2. |
| 23 | 928 | 849 | 879 | 51.1 | 86.2 | 56.7 | .258 | .762 | .342 | .71 | .62 | .78 | WSW | SSW | SSW | 88.30 | 2.0 | ... | ... | Do. | Clear. | Clear. |
| 24 | 812 | 884 | 806 | 47.2 | 69.2 | 60.3 | .249 | .529 | .456 | .77 | .75 | .88 | NEbE | WSW | NEbE | 30.80 | 2.0 | In'p. | ... | C. C. Str. 6. | Sli't Shower. | Cu. Str. 10. |
| 25 | 778 | 845 | 834 | 56.1 | 77.5 | 67.0 | .391 | .632 | .438 | .87 | .67 | .68 | NEbE | NEbE | SSE | 24.80 | 1.5 | ... | ... | Clear. | Cu. Str. 2. | Clear. [& th. |
| 26 | 750 | 720 | 700 | 60.1 | 89.8 | 68.2 | .374 | .802 | .510 | .73 | .57 | .75 | NbE | SSE | SE | 42.90 | 1.5 | ... | ... | C. Cirr. 4. | C. Cu. 4. | C.C. 4. Dis.li't. |
| 27 | 665 | 572 | 634 | 64.6 | 96.0 | 76.1 | .427 | .633 | .652 | .71 | .38 | .73 | SbW | SW | S | 61.10 | 2.0 | ... | ... | Clear. | Clear. | Cu. Str. 4. |
| 28 | 667 | 654 | 667 | 66.0 | 96.1 | 77.6 | .476 | .626 | .564 | .75 | .37 | .61 | WSW | SSE | SEbE | 20.80 | 1.0 | ... | ... | C. C. Str. 6. | Cu. Str. 4. | Do. 2. |
| 29 | 666 | 598 | 572 | 62.4 | 89.9 | 70.7 | .370 | .630 | .462 | .66 | .45 | .65 | SSE | E | W | 56.80 | 2.0 | ... | ... | Clear. | Cirr. 4. | Do. 10. |
| 30 | 416 | 322 | 480 | 60.5 | 76.2 | 53.0 | .456 | .652 | .348 | .88 | .73 | .86 | SE | SEbE | WSW | 191.70 | 2.5 | 0.329 | ... | Cu. Str. 10. | C. C. 10. | Do. 4. |
| ... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ... | ... | ... | ...... | ...... | ...... | ...... | ... | ... | ... | ......... | ......... | ......... |

# MONTHLY METEOROLOGICAL REGISTER, ST. MARTIN, ISLE JESUS, CANADA EAST—JULY, 1862.

(NINE MILES WEST OF MONTREAL.)

BY CHARLES SMALLWOOD, M.D., LL.D.

*Latitude*—45 *deg.* 32 *min. North. Longitude*—73 *deg.* 36 *min. West. Height above the Level of the Sea*—118 *feet.*

| Day. | Barom. corrected and reduced to 32° | | | Temp. of the Air.—F. | | | Tension of Vapour. | | | Humidity of Air. | | | Direction of Wind. | | | Horizontal Movement in Miles in 24 hours. | Mean of Ozone. t'nths | Rain in inches. | Snow in inches. | Weather, &c. A Cloudy sky is represented by 10; A cloudless sky by 0. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | 6 A. M. | 2 P. M. | 10 P. M. | | | | | 6 A. M. | 2 P. M. | 10 P. M. |
| 1 | 29.517 | 29.495 | 29.599 | 50.0 | 67.8 | 60.0 | .309 | .418 | .365 | .85 | .62 | .76 | w s w | w s w | s w | 193.10 | 2.0 | ... | ... | Cu. Str. 4. | Clear. | Cu. Str. 4. |
| 2 | 671 | 743 | 854 | 60.1 | 84.2 | 62.9 | 374 | 584 | 429 | 73 | 50 | 77 | s s w | s w | s b E | 82.80 | 1.5 | ... | ... | C. C. Str. 4. | Do. | C. Cirr. 4. |
| 3 | 905 | 883 | 30.030 | 54.7 | 84.2 | 63.0 | 282 | 677 | 429 | 67 | 60 | 77 | s E | s s w | s s E | 25.40 | 1.0 | ... | ... | Clear. | Cirr. 2. | C.Str.4.Dt.T.& |
| 4 | 30.062 | 943 | 29.933 | 56.4 | 89.8 | 73.1 | 308 | 848 | 624 | 69 | 61 | 79 | s b w | s w | s b w | 197.10 | 1.0 | ... | ... | Do. | Cu. Str. 4. | C. C. Str.4.[L. |
| 5 | 29.853 | 814 | 762 | 70.0 | 93.5 | 74.2 | 592 | 887 | 641 | 83 | 56 | 77 | w s w | s w | s w | 103.20 | 1.5 | 0.050 | ... | Do. | Rain. Dis. th. | C. Str 5. |
| 6 | 642 | 588 | 623 | 70.6 | 94.0 | 73.0 | 592 | 840 | 552 | 83 | 55 | 70 | w s w | w s w | s s w | 285.50 | 1.0 | ... | ... | Hazy. | Hazy. | Hazy. |
| 7 | 754 | 600 | 468 | 63.3 | 84.3 | 71.0 | 416 | 704 | 476 | 72 | 60 | 64 | s | w s w | s b w | 55.60 | 1.0 | ... | ... | Do. | Do. | Do. |
| 8 | 451 | 472 | 547 | 65.0 | 85.4 | 54.7 | 576 | 657 | 276 | 92 | 55 | 65 | s b w | s w | s w | 86.40 | 1.0 | Inap. | ... | Slight Rain. | Clear. | C. C. Str. 8. |
| 9 | 414 | 397 | 642 | 47.4 | 61.4 | 45.4 | 249 | 442 | 245 | 77 | 83 | 81 | s w | s s w | s w | 114.40 | 2.5 | 0.206 | ... | Cu. Str. 10. | Rain. | Cu. Str. 4. |
| 10 | 702 | 735 | 759 | 49.5 | 70.6 | 54.7 | 273 | 616 | 315 | 80 | 57 | 78 | w s w | w b s | w b s | 103.80 | 1.5 | ... | ... | Clear. | Clear. | Clear. |
| 11 | 800 | 765 | 801 | 52.1 | 79.8 | 66.2 | 257 | 606 | 438 | 66 | 60 | 68 | w s w | w s w | w b s | 182.60 | 1.0 | ... | ... | Hazy. | Hazy. | Hazy |
| 12 | 738 | 555 | 550 | 58.9 | 72.6 | 65.4 | 358 | 489 | 451 | 73 | 62 | 73 | w | s w | s | 211.90 | 1.0 | ... | ... | Do. | Do. | Do. |
| 13 | 496 | 344 | 479 | 64.2 | 82.2 | 75.2 | 464 | 572 | 897 | 77 | 52 | 71 | s w | w s w | s s w | 149.50 | 2.0 | 0.300 | ... | Cu. Str. 10. | C. Cirr. 8. | Cu. Str. 4. |
| 14 | 606 | 644 | 760 | 50.0 | 73.6 | 60.5 | 240 | 545 | 403 | 68 | 67 | 79 | N E b E | s b E | s w | 86.10 | 1.0 | ... | ... | Do. 6. | Do. 8. | Clear. |
| 15 | 722 | 701 | 611 | 49.4 | 86.0 | 62.4 | 272 | 684 | 517 | 78 | 56 | 91 | s w | s s w | N E b E | 83.60 | 2.5 | 0.533 | ... | Clear. H.Dew. | Do. 4. | Nimb. 10. |
| 16 | 666 | 604 | 742 | 60.1 | 79.2 | 60.2 | 439 | 612 | 396 | 88 | 62 | 76 | s b w | s E | w | 235.40 | 2.0 | ... | ... | Do. | Do. 8. | Clear:DtT.&L. |
| 17 | 806 | 785 | 929 | 58.6 | 69.0 | 62.8 | 365 | 501 | 413 | 76 | 72 | 77 | N E b E | N E b E | s b w | 123.00 | 1.0 | ... | ... | Cu. Str. 10. | Cirr. 4. | Do. |
| 18 | 950 | 956 | 947 | 54.1 | 85.0 | 64.2 | 315 | 739 | 433 | 77 | 62 | 73 | N E b E | s b w | s b w | 28.10 | 1.5 | ... | ... | Clear. | Clear. | Str. 2. |
| 19 | 896 | 794 | 781 | 60.5 | 80.9 | 65.6 | 367 | 592 | 444 | 71 | 57 | 71 | s w | s w | s s E | 35.50 | 1.0 | ... | ... | C. Cirr. 4. | C. C. Str. 10. | Cirr. 2. |
| 20 | 654 | 593 | 618 | 63.2 | 70.9 | 61.3 | 510 | 544 | 413 | 88 | 73 | 77 | s s E | s b E | s b E | 154.40 | 2.0 | 0.100 | ... | Cu. Str. 10. | Do. 8. | Cu. Str 2. |
| 21 | 717 | 704 | 842 | 51.1 | 77.9 | 69.0 | 296 | 632 | 564 | 79 | 67 | 79 | N b E | N E b E | s E | 59.65 | 1.0 | ... | ... | Clear. | Do. 4. | Str. 2. |
| 22 | 810 | 796 | 805 | 54.6 | 79.1 | 68.0 | 301 | 651 | 453 | 71 | 66 | 79 | s E | s s w | s s w | 107.80 | 1.0 | ... | ... | Do. | Do. 9. | Cu. Str. 10. |
| 23 | 705 | 565 | 424 | 54.1 | 58.0 | 56.0 | 390 | 459 | 420 | 93 | 97 | 94 | s s w | s s w | s s w | 268.50 | 3.0 | 0.656 | ... | Nimb. 10. | Rain. | Do. 10. |
| 24 | 556 | 566 | 614 | 64.1 | 83.6 | 63.0 | 529 | 802 | 453 | 89 | 72 | 94 | s w | s w | s b w | 201.50 | 2.5 | 0.094 | ... | C. Cirr. 2. | Cirr. 4. | Do. 10. |
| 25 | 636 | 604 | 632 | 60.0 | 77.9 | 62.4 | 453 | 632 | 436 | 85 | 67 | 80 | s s w | s w | s w | 120.10 | 2.0 | ... | ... | Rain. | Clear. | Str. 2. |
| 26 | 694 | 679 | 762 | 68.4 | 81.7 | 60.9 | 453 | 451 | 449 | 80 | 73 | 85 | s s w | s w | s w | 106.40 | 1.5 | Inap. | ... | C. C. Str. 2. | Cirr. Str. 4. | Cu.Str.4·D.Th. |
| 27 | 754 | 716 | 796 | 68.1 | 80.9 | 64.2 | 485 | 592 | 529 | 78 | 57 | 89 | w s w | w s w | w s w | 199.00 | 2.0 | 0.400 | ... | Clear. H.Dew. | Clear. | Do. 10. |
| 28 | 764 | 735 | 781 | 64.1 | 77.3 | 62.1 | 644 | 639 | 491 | 77 | 69 | 88 | s w | s w | s b E | 34.60 | 2.0 | 0.271 | ... | Cu. Str. 6. | Cu. Str. 10. | Do. 10. |
| 29 | 799 | 652 | 703 | 64.0 | 78.9 | 57.2 | 569 | 863 | 436 | 97 | 89 | 94 | s b w | s s w | s w | 25.60 | 2.0 | 1.157 | ... | Rain. | C. C. Str. 9. | C.Str.4.Sh'wr. |
| 30 | 696 | 741 | 895 | 61.4 | 81.6 | 69.9 | 449 | 617 | 592 | 85 | 58 | 83 | s w | s w | s b w | 39.50 | 2.5 | ... | ... | C. C. Str. 10. | Do. 9. | Clear.[Dis.Th. |
| 31 | 885 | 874 | 907 | 64.6 | 90.1 | 70.1 | 490 | 834 | 523 | 81 | 58 | 72 | N N w | s E | s s w | 8.80 | 1.5 | ... | ... | Clear. | Cum. 3. | Do. |

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR JUNE, 1862.

| | | |
|---|---|---|
| Barometer | Highest, the 16th day | 30.114 |
| | Lowest, the 30th day | 29 322 |
| | Monthly Mean | 29.713 |
| | Monthly Range | 0.792 |
| Thermometer | Highest, the 28th day | 96°1 |
| | Lowest, the 26th day | 36°2 |
| | Monthly Mean | 64°61 |
| | Monthly Range | 59°9 |
| Greatest intensity of the Sun's rays | | 101°2 |
| Lowest point of Terrestrial Radiation | | 33°1 |
| Mean of Humidity | | .660 |
| Amount of evaporation | | 4.16 |

Rain fell on 8 days, amounting to 1.132 inches; it was raining 18 hours and 15 minutes, and was accompanied by thunder on 2 days.

Most prevalent wind, S.W.

Least prevalent wind, E.

Most windy day, the 22nd day; mean miles per hour, 9.62.

Least windy day, the 2nd day; Calm.

The Eclipse of the Moon was visible.

The Electrical state of the Atmosphere has indicated high intensity.

Fire flies (*Lampyris Corusca*) 1st seen 11th day.

## REMARKS ON THE ST. MARTIN, ISLE JESUS, METEOROLOGICAL REGISTER FOR JULY, 1862.

| | | |
|---|---|---|
| Barometer | Highest, the 4th day | 30.062 |
| | Lowest, the 9th day | 29.397 |
| | Monthly Mean | 29.731 |
| | Monthly Range | 0.665 |
| Thermometer | Highest, the 6th day | 94°.0 |
| | Lowest, the 14th day | 40°.0 |
| | Monthly Mean | 65.°33 |
| | Monthly Range | 54°.0 |
| Greatest intensity of the Sun's Rays | | 102°.1 |
| Lowest Point of Terrestrial Radiation | | 37°.4 |
| Mean of Humidity | | .737 |
| Amount of evaporation | | 3.01 |

Rain fell on 12 days, amounting to 3.767 inches; it was raining 35 hours and 6 minutes, and was accompanied by thunder on 5 days.

Most prevalent wind, the S. W.

Least prevalent wind, the S.

Most windy day, the 6th; mean miles per hour, 11.81.

Least windy day, the 31st; mean miles per hour, 0.37.

The Electrical state of the Atmosphere has indicated moderate intensity.

AMERICAN ASSOCIATION
FOR THE ADVANCEMENT
OF SCIENCE

THE

# CANADIAN JOURNAL

OF

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# THE CANADIAN JOURNAL.

NEW SERIES.

No. XLII.—NOVEMBER, 1862.

## NOTES ON PASSAGES IN THE PLATONIC DIALOGUES.

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### NOTE I.

Ἀλλα μεν δη διοτι φιλειται ὑπο θεων, φιλουμενον ἐστι και θεοφιλες [το θεοφιλες].—(*Euthryphro.* § 12. Bekker).

The last two words, which I have enclosed within brackets, have been added on pure conjecture—"de sola Bastii conjectura," as Stallbaum writes. They have been received by Bekker into his text; and Stallbaum, in a long note, endeavours to prove, that, without the addition, the passage has no tolerable meaning. I venture to think, however, that the emendators of the text are here in the wrong; and that the proposed addition, instead of being necessary, mars the sense of the passage.

To shew this, it will be sufficient to indicate the line of thought in that part of the dialogue where the sentence under consideration occurs. Euthyphro has given a definition of holiness as "that which is loved by the gods;" in other words, the doctrine has been laid down, that, to be God-loved (θεοφιλες), and to be holy (ὁσιον). are interchangeable expressions. Against this view Socrates directs a battery of argument, as follows:

A. 1. An object of love is not loved, because it is a loved thing (*ὀυχ ὁτι φιλουμενον ἐστι, φιλειται*).

2. But it is a loved thing, because it is loved (*ὁτι φιλειται, φιλουμενον*).

B. 1. With reference to holiness in particular, it is loved by the Gods because it is holy (*διοτι ἀρα ὁσιον ἐστι, φιλειται*).

2. Its being loved by the Gods is not what makes it holy (*ὀυχ ὁτι φιλειται, δια τουτο ὁσιον ἐστιν*).—The circumstance of its being loved by the Gods makes it merely (A. 2) a God-loved thing (*Ἀλλα μεν δη διοτι φιλειται ʽυπο θεων, φιλουμενον ἐστι και θεοφιλες*).—This is the sentence which is supposed to need emendation. But, taking it, as I have done, without Bast's supplement, its effect is to throw a fuller light upon the *negative* statement, that the circumstance of holiness being loved by the Gods is not what makes it holy, by shewing *positively* that this circumstance makes holiness God-loved (*θεοφιλες*), and nothing more.

C. Hence it follows that the holy and the God-loved are not (as Euthryphro's definition implied) the same. For, on supposition of their being the same (*ἐι γε τἀυτον ἠν*), a twofold contradiction arises.

*First*, it has been granted (B. 1) that the holy is loved because it is holy. But, by hypothesis, the holy and the God-loved are the same. Substitute, therefore, God-loved for holy in the proposition (B. 1) just quoted; and the proposition will become—the God-loved is loved because it is God-loved: which is at variance with A. 1. (*Ἐι γε ταὐτον ἠν, ᾽ω φιλε Ἐυθυφρον, το θεοφιλες και το ὁσιον, ἐι μεν δια το ὁσιον ἐιναι ἐφιλειτο το ὁσιον, καί δια το θεοφιλες ἐιναι ἐφιλειτο ἀν το θεοφιλες*).

*Again*, it has been granted (A. 2) that the God-loved is God-loved because it is loved by the Gods. This proposition, by the substitution of holy for God-loved, according to the hypothesis of the identity of *το ὁσιον* with *το θεοφιλες*, becomes—the holy is holy because it is loved by the Gods: which is at variance with B. 2. (*Ἐι δε δια το φιλεισθαι ὑπο θεων το θεοφιλες θεοφιλες ἠν, και το ὁσιον ἀν δια το φιλεισθαι ὁσιον ἠν*).

The argument thus sketched is clear, consistent, steadily progressive, and (on the premises assumed) conclusive.

Were it not for Stallbaum's extraordinary comment, I would consider it unnecessary to say anything regarding the logical propriety of the interchange (C) of the terms holy and God-loved. We must distinguish between a judgment in which one thing is merely predicated of another—as "God is good"—and a definition exhibiting the full and exact nature of the thing defined—as "a triangle is a three-sided figure." In the latter case, wherever the expression *triangle* occurs, we may without error replace it by *three-sided figure*: and conversely. But of course such a procedure would in the former case be absurd. Now Stallbaum actually argues that the passage under consideration, without some such addition as Bast has suggested, involves a fallacy, inasmuch as, the holy having been defined to be the God-loved, ὁσιον and θεοφιλες are thereafter treated as interchangeable terms! How could the learned critic forget that the proposition, "holiness is that which is loved by the Gods," is taken, throughout the argument, not as the mere predication of a quality which may belong to other objects as well as to holiness, but as a definition exhibiting exactly the essential nature of holiness? A passage of the Protagoras may be referred to by way of illustration. Protagoras had been led to identify *the pleasant* and *the good*, so as to make the proposition, "the good is that which is pleasant," a definition exhibiting the exact nature of the good. He had also asserted that men often do evil, knowing that it is evil, in consequence of being overcome by pleasures. Here Socrates takes him up, and insists that *pleasure* be replaced by *good*, according to the definition which had been given of the latter term; which being done, the doctrine of Protagoras is reduced to this: that men often do evil, knowing that it is evil, in consequence of being overcome by good. *ἠ γελοιον λεγετε πραγμα, ἐι πραττει τις κακα, γιγνωσκων ὅτι κακα ἐστιν, ὀυ δεον ἀυτα πραττειν, ἡττωμενος ὑπο των ἀγαθων.*—(*Protagoras*, § 111. Bekker.)

It may be observed, that, while endeavouring to prove that morality (more precisely, holiness) is not dependent on *the will* of God, Plato does not represent it as independent of *the nature* of God. In fact, in his maturest dialogues, as we may afterwards have occasion to point out, he connects all eternal and unchangeable reality with the Divine nature; and there is nothing in the Euthyphro at variance with such a view.

Sir James Macintosh, in his *Dissertation on the Progress of Ethical Philosophy*, describes Duns Scotus as "the first whose language inclined towards that most pernicious of moral heresies, which represents morality to be founded on will;" and he adds that William of Ockham "went so far beyond this inclination of his master, as to affirm, that, if God had commanded his creatures to hate himself, the hatred of God would ever be the duty of man." I presume that what is here meant, is, that Scotus was the first *of the scholastic writers* whose language inclined towards the heresy in question; for, the discussion in the Euthyphro, of which Sir James Mackintosh cannot have been ignorant, is sufficient to shew that there were persons even in the days of Plato who founded morality on will. Our philosopher would not have entered into an elaborate argument to disprove an opinion which no one maintained. The terms in which Macintosh characterises the doctrine which finds the ground of moral distinctions in the will of God are worthy of being quoted. "The doctrine of Ockham, which by necessary implication refuses moral attributes to the Deity, and contradicts the existence of a moral government, is practically equivalent to Atheism. As all devotional feelings have moral qualities for their sole object; as no being can inspire love or reverence otherwise than by those qualities which are naturally amiable or venerable; this doctrine would, if men were consistent, extinguish piety, or, in other words, annihilate religion. Yet so astonishing are the contradictions of human nature, that this most impious of all opinions probably originated in a pious solicitude to magnify the sovereignty of God, and to exalt his authority even above his own goodness."

## NOTE II.

*Ψυχη πασα ἀθανατος. το γαρ . . . . ἀθανατον ψυχη ἀν ἐιη.*—(*Phaedrus*, §§ 51, 52, 53. Bekker).

I am not satisfied with what the commentators whom I have had an opportunity of consulting have written regarding the structure of this famous passage. The immortality of the soul is what is sought to be established. Now the point which does not seem to me to have been made sufficiently plain, is, that the passage contains two distinct arguments; and that the premises of the one are intermingled (though not in a confused manner) with those of the other; the conclusion not being expressed in connection with each of the courses of reasoning separately, but being formally deduced, once for all, only after the premises of both arguments have been fully stated. The following scheme, in which the proposition marked *g* is the conclusion, following in a strictly logical manner from the premises of either argument, and therefore legitimately deduced by Plato from the premises of both combined, will make the matter clear.

ARGUMENT I.

*a.* What is always moved is immortal.
*b.* What is self-moving is always moved.
*c.* Every soul is self-moving.

ARGUMENT II.

*c.* Every soul is self-moving.
*d.* What is self-moving is a principle of motion.
*e.* A principle is unproduced.
*f.* What is unproduced is indestructible and immortal.

*g.* Therefore every soul is immortal.

The order in which the propositions forming the premises of these arguments are brought forward by Plato is the following:—(*a*). το γαρ ἀεικινητον ἀθανατον.—(*b*). μονον δη το ἀυτο κινουν, ἁτε ὀυκ ἀπολειπον ἑαυτο, ὀυ ποτε ληγει κινουμενον.—(*d*). τουτο πηγη και ἀρχη κινησεως.—(*e*). ἀρχη δε ἀγενητον.—(*f*). ἐπειδη δε ἀγενητον ἐστι, και ἀδιαφθορον ἀυτο ἀναγκη ἐιναι.—(*c*). ἀθανατου δε πεφασμενου του ὑφ᾽ ἑαυτου κινουμενου, ψυχης ὀυσιαν τε και λογον τουτον ἀυτον τις λεγων ὀυκ ἀισχυνεται.

With regard to the expression in (*c*), ἀθανατου δε πεφασμενου του ὑφ᾽ ἑαυτου κινουμενου, it may be remarked, that, though the position: *what is self-moving is immortal*, has not been formally and in express terms laid down in the previous part of the argument, propositions have been laid down, viz.: (*a*) and (*b*), which logically involve it.

I may add, as Ast, in a note quoted by Bekker, distinguishes between πηγη and ἀρχη in (*d*), making the former the *principium reale seu materiale*, and the latter the *principium ideale seu formale*, that there is not the shadow of a foundation for the distinction in the writings of Plato. That the alleged distinction was not in Plato's mind when he wrote the passage under consideration, and that it has nothing to do with the course of his argument, is obvious from this, that, while he employs both πηγη and ἀρχη, as if to give fullness and emphasis to the statement, in the clause where the idea of a principle first appears, he uses only the latter of these expressions in the subsequent part of the reasoning: *τουτο πηγη και ἀρχη κινησεως. ἀρχη δε ἀγενητον κ. τ. λ.*

## NOTE III.

*Ἀρχη δε ἀγενητον· ἐξ ἀρχης γαρ ἀγαγκη παν το γιγνομενον γιγνεσθαι, ἀυτην δε μηδ᾽ ἐξ ἑνος· ἐι γαρ ἐκ του ἀρχη γιγνοιτο, ὀυκ ἀν ἐξ ἀρχης γιγνοιτο.* —(*Phaedrus*, § 51. Bekker.)

The proposition, *a principle is unproduced*, which forms the Premiss (*e*) of Argument II., Note II., Plato supports by the reasoning, *ἐξ ἀρχης γαρ ἀναγκη κ. τ. λ.* Great difficulty, however, appears to have been found with the text as it stands; and various conjectural emendations of the last clause, *ὀυκ ἀν ἐξ ἀρχης γιγνοιτο*, have been suggested. From the notes in Bekker's Plato I extract the following specimens:

(*a*). *ὀυκ ἀν ἀρχη γιγνοιτο* (Muretus).
(*b*). *ὀυκ ἀν ἐτι ἀρχη γενοιτο* (Buttmann—approved by Heindorf.)
(*c*). *ὀυκ ἀν ἠν ἐτι ἀρχη* (Ast).
(*d*). *ὀυκ ἀν ἐξ ἀρχης γιγνοιτο τουτο* (Schleiermacher).

I have a strong persuasion that the text stands in no need of alteration, and that it is only in consequence of Plato's real course of thought having been misapprehended that alteration has been deemed necessary. The argument of the passage may, I conceive, be thus presented:

(*α*). Proposition to be proved:—A principle is unproduced (*ἀρχη δε ἀγενητον*).

(*β*). In seeking to establish this, the first position laid down, is, that every thing which is produced is of necessity produced from a principle (*ἐξ ἀρχης γαρ ἀναγκη παν το γιγνομενον γιγνεσθαι*). The position here asserted, which is presumed to be self-evident, leads directly to what is sought to be proved, that a principle is not produced from anything (*ἀυτην δε μηδ᾽ ἐξ ἑνος*).

(*γ*). For suppose, if possible, that the proposition sought to be proved is not true; in other words, suppose a principle to be produced from something (*ἐι γαρ ἐκ του ἀρχη γιγνοιτο*).

(δ). Then, in the case supposed, the production would not take place from a principle (ὀυκ ἀν ἐξ ἀρχης γιγνοιτο), inasmuch as, if it did, there would be two principles, the one produced from the other—a view, the absurdity of which is to Plato too apparent to require to be expressly set forth.

(ε). But the conclusion (δ) is contradictory of the Premiss (β); and therefore the hypothesis (γ) is untenable. In other words, the Proposition sought to be proved is established.

While the unamended text thus yields an intelligible and (from the Platonic point of view) conclusive argument, the readings suggested by Muretus (*a*), Buttmann (*b*), and Ast (*c*), reduce the import of the reasoning contained in the clause, ἐι γαρ ἐκ του ἀρχη γιγνοιτο κ. τ. λ, to this: *a principle is unproduced, for if it were not, it would not be a principle;* where it is plain that no real advancement in the demonstration is made. Why (the reader asks) is it impossible for that which is produced to be a principle? The only conceivable answer is, that, if what is produced were a principle, there would be two principles, the one produced from the other. Now this is exactly what the unamended text expresses; so that the emendations suggested by the eminent scholars named, reject from the text an idea which Plato must be understood to have had in his mind. But more, in the passage as amended, the clause ἐξ ἀρχης γαρ ἀναγκη παν το γιγνομενον γιγνεσθαι, which we cannot suppose Plato to have introduced without a purpose, serves absolutely no purpose whatsoever.

According to Schleiermacher's amendment (*d*), τουτο refers to the preceding ἐκ του. The argument then is: *if a principle* (which we may call *P*), *is produced from anything* (as from *x*), *it will follow* that this *x* (τουτο) *is not produced from a principle.* This view appears the most unsatisfactory of all. Besides being open to other objections, it attributes to Plato irrelevant reasoning—which we are not gratuitously to do. For, though *x* were not produced from a principle, what then? Let it be conceived that *x* is not produced at all. This does not (at least, directly) warrant the inference that *P* is unproduced.

## Note IV.

'Οιδα γαρ ἀνδρα ἑνα Πρωταγοραν πλειω χρηματα ἀπο ταυτης της σοφιας ἢ Φειδιαν γε, ὁς ὁυτω περιφανως καλα ἐργα ἐιργαζετο, και ἀλλους δεκα των ἀνδριαντοποιων.—(*Meno.* § 29. Bekker.)

Heindorf proposes to read τε for γε; and Buttmann assents to the change: "Heindorfio assentior corrigenti τε, quam particulam ante illud και ἀλλους abesse posse non credo." Stallbaum intimates his concurrence in Buttmann's remark. On a point which is purely one of Greek scholarship, the opinion of these learned men is entitled to the highest consideration; yet I feel some difficulty in accepting their decision. *In the first place*, the particle γε is uncommonly appropriate. It has a fine delicate ironical effect. Socrates (who is the speaker) says in substance: One man, Protagoras, derived from the exercise of his talents as a sophist, an amount of money, *not greater perhaps than such a man was entitled to expect from such a profession*, but greater at any rate (γε) than was obtained from the practice of their art by Phidias and ten other statuaries besides. *In the next place*, I question, whether, if τε were substituted for γε, a sense would not be imposed upon the passage, different from what Plato wishes to express. "When we find τε in the first sentence, and και in the latter, . . . . the meaning conveyed is, that what is affirmed generally (τε = in any way) of the former, is affirmed in the same way in the latter (και = in this)."—(*Donaldson's New Cratylus*, p. 246.) On this principle, if the reading τε were adopted in the passage before us, the meaning would be, that Protagoras amassed more money than was earned by Phidias, or by any ten other statuaries. But this does not seem to be the exact shade of thought. Plato's meaning I take to be, that Protagoras made more money than Phidias and ten other statuaries *put together*. Now compare the following parallel passage: ὀυκ ἀποδεχομαι ἐμαυτου ὀυδε ὡς ἐπειδαν ἑνι τις προσθη ἑν, ἢ το ἑν ὡ προσετεθη δυο γεγονεν, ἢ το προστεθεν και ὡ προσετεθη δια την προσθεσιν του ἑτερου τω ἑτερω δυο ἐγενετο (*Phaedr.* § 104. Bekker); "I do not so much as admit, when one is added to one, either that the one to which the addition was made has become two, or that the unit to which the addition was made and that which was added to the former *taken together* (το προστεθεν και ὡ προσετεθη) became two on account of the addition of the one to the other." Here it will be observed that τε does not occur in the first member of the expression.

## NOTE V.

ΣΩ. Τω ὀυκ ἐιδοτι ἀρα περι ὡν ἀν μη ἐιδη ἐνεισιν ἀληθεις δοξαι περι τουτων ὡν ὀυκ ὀιδεν. MEN. Φαινεται . . . . ΣΩ. Ἐι ὀυν ὁν ἀν ἠ χρονον και ὁν ἀν μη ἠ ἀνθρωπος ἐνεσονται ἀυτω ἀληθεις δοξαι, ἁι ἐρωτησει ἐπεγερθεισαι ἐπιστημαι γιγνονται, ἀρ᾽ ὀυν τον ἀει χρονον μεμαθηκυια ἐσται ἡ ψυχη ἀυτου.—(*Meno*, §§ 20, 21. Bekker).

This passage, which Stallbaum condemns as irreconcilable with the immediately preceding part of the dialogue, and as vicious in its logic, is not, in my judgment, open to either of these objections. Rightly interpreted, it is both in harmony with the rest of the dialogue, and (I say nothing of the principles which Plato assumes) unexceptionable in its logical form. The point sought to be established, is, that there never was a time, in this life or before it, when the human soul had not in it true opinions, in a latent or undeveloped state—a view involving the existence of the soul throughout at least all past time; and the several steps of the argument on which this conclusion is made to rest are as follows :

*a.* Learning (*ὁ δη μαθησιν καλουσιν ἀνθρωποι*) is reminiscence, that is, the recovery, from within the depths of one's own soul, of knowledge formerly possessed. This is supposed to be proved by an experiment performed by Socrates on one of Meno's attendants; from which it appeared that there were in the boy's mind true opinions regarding things of which he had no knowledge (*τω ὀυκ ἐιδοτι ἀρα περι ὡν ἀν μη ἐιδη ἐνεισιν ἀληθεις δοξαι*), and that the process of learning was merely the development of these latent true opinions into knowledge (*και νυν μεν γε ἀυτω ὡς περ ὀναρ ἀρτι ἀνακεκινηνται ἁι δοξαι ἁυται*).

*b.* In a case like that of Meno's attendant, awaking, under the interrogations of Socrates, to a knowledge of truths of which he had all his life before been ignorant, the knowledge acquired, as it was not always possessed (*ὀυκουν ἐι μεν ἀει ἐιχεν, ἀει και ἠν ἐπιστημων*), and as it is seen to be not an absolutely new acquisition, but merely the development of what has been lying dormant in the mind, must have been received at some former time (Ἀρ᾽ *ὀυν ὀυ την ἐπιστημην, ἡν νυν ὁυτος ἐχει, ἠτοι ἐλαβε ποτε ἠ ἀει ἐιχεν ; ναι*). Since, by hypothesis, it was not received at any previous time in the present life (ἠ δεδιδαχε τις τουτον γεωμετρειν; ὁυτος γαρ κ. τ. λ), it must have been received at a time antecedent to the present life (ἐι δε μη ἐν τω νυν βιω λαβων ὀυκ ἠδει τουτο, δηλον ὁτι ἐν ἀλλω τινι χρονω ἐιχε και μεμαθηκει).—There is a point here which needs a word of explanation. If knowledge now gained for the first time in the present life be old knowledge revived, the knowledge must unquestionably have been *possessed* in a former life. Does this, however, imply that it must have been *received* in a former life? Only if we assume that the possession of knowledge is conditioned upon the reception of it, in other words, upon an act of learning. Now Plato does, in fact, make this assumption. Knowledge not being necessarily and always in the mind (ὀυκουν ἐι μεν ἀει ἐιχεν, ἀει και ἠν ἐπιστημων), the circumstance of its being found at any time in our possession, is regarded as a result and evidence of its having been received or learned. Observe the expression, ἐιχε και μεμαθηκει. He—Meno's attendant—*was in possession of* such and such knowledge, and *had learned it;* which is equivalent to: *he was in possession of it through having learned it.*

*c.* Since (*a*) learning is reminiscence, or the development of latent true opinions into knowledge; and since (*b*) we had knowledge, resulting from our having learned, at a time antecedent to the present life, it follows, that, at a time antecedent to the present life, the soul was in possession of ἀληθεις δοξαι, capable of being evoked into ἐπιστημαι.

*d.* Hence there never has been a time, in this life, or before it, when the soul was not in possession of ἀληθεις δοξαι (ἐι ὀυν ὁν ἀν ἠ χρονον και ὁν ἀν μη ἠ ἀνθρωπος, ἐνεσονται ἀυτω ἀληθεις δοξαι, ἁι ἐρωτησει ἐπεγερθεισαι ἐπιστημαι γιγνονται, ἀρ᾽ ὀυν τον ἀει χρονον μεμαθηκυια ἐσται ἠ ψυχη ἀυτου; δηλον γαρ ὁτι τον παντα χρονον ἐστιν ἠ ὀυκ ἐστιν ἀνθρωπος).—Stallbaum represents Plato as here arguing, that, because ἀληθεις δοξαι not only are in the soul now, but were in it before our birth into this world, it must have possessed them always. His words are: "Animadvertes autem hanc argumentationem. Opiniones illas, inquit, quae interrogando excitatae scientiam efficiunt, non in hac demum vita accipit homo, sed animus secum attulit, quum in hoc corpus migraret. Quum igitur illas et eo tempore habuerit, quo nondum natus erat, et easdem in hac vita semper teneat, sequitur ut eas τον ἀει χρονον susceperit." Of course, nothing can be feebler than the case so put: as Stallbaum remarks: "Quae quidem conclusio quam arguta, quamque infirma sit, nemo non videt." It is doing Plato gross injustice, however, to father such weakness upon him. We may perhaps be of opinion, that, in winding up his argument, he does not express himself so fully as he might have done; but the reasoning, as he has left it, may have been sufficient for those to whom it was addressed; and, at any rate, he is entitled to a candid and liberal interpretation of his language. What he *should* have said, to render his argument logically complete, is sufficiently obvious. Starting with the simple fact, that, in this life, say $L_1$, the soul has in it true opinions capable of being developed into knowledge, he has inferred (*c*) that the same thing holds good of a previous life, say $L_2$. Now, in order that he might reach his grand conclusion, it was only necessary for him to add, that, by a repetition of the reasoning, the same thing could be shewn to hold good regarding a still prior life, say $L_3$; and so on, without limit. The terms $L_1$, $L_2$, $L_3$, &c., forming an infinite series, carry us back through all time (*παντα χρονον*); and, let us recede into the past as far as we please, we never reach a point where the soul is not in possession of latent true opinions, or, what is involved in this, where it is not found in the condition of having learned (*τον ἀει χρονον μεμαθηκυια ἐσται*) This is manifestly what Plato should have said. Is it not what he *has* said? In substance, I believe it is. His statement is exactly to the following effect: *true opinions are in the soul of any one, both while he is a man, and while he is not* [not simply before he became a man, but (ὁν ἀν μη ἢ ἀνθρωπος) during all the time when he was not a man, in other words, throughout the whole time that preceded his birth]; *therefore*, &c. The first position here laid down, that true opinions are in a person's soul while he is a man, has been proved by the example of Meno's attendant. The proof of the next position, that true opinions were in the person during the whole of the time when he was not a man, has not indeed been fully drawn out in a formal manner. But having demonstrated (as he conceives himself to have done) that true opinions were in the soul in a life anterior to the present, and having demonstrated this as a corollary from the fact that they are in the soul in the present life, Plato probably thought that his readers would have no difficulty in perceiving for themselves that the same considerations which evince the present life to be the sequel of a preceding, in which the soul had true opinions in it, are sufficient to warrant the conclusion that that preceding life was the sequel of one prior still, in which also the soul had true opinions in it; and so on without limit, through all past time.—Q. E. D.

The passage which Stallbaum regards as inconsistent with that which has been expounded, is the following: Ἁτε ὀυν ἡ ψυχη ἀθανατος τε ὀυσα και πολλακις γεγοννια, και ἑωρακυια και τα ἐνθαδε και τα ἐν Ἁιδου και παντα χρηματα, ὀυκ ἐστιν ὁ τι ὀυ μεκαθηκεν, ὡστε ὀυδεν θαυμαστον και περι ἀρετης και περι αλλων ὁιον τε ἐιναι ἀυτην ἀναμνησθηναι ἁ γε και προτερον ἠπιστατο. ἁτε γαρ της φυσεως ἁπασης συγγενους ὀυσης, και μεμαθηκυιας της ψυχης ἁπαντα, ὀυδεν κωλυει ἑν μονον ἀναμνησθεντα, ὁ δη μαθησιν καλουσιν ἀνθρωποι, τἀλλα παντα ἀυτον ἀνευρειν.—(*Meno*, § 15). Stallbaum's words are: "Quum enim in superiore disputatione" (the passage just quoted, the *earlier* of the two) "animum in alia atque alia loca migrasse eoque modo omnia didicisse dixerit, ecquis est quin male hic" (the passage discussed in the former part of our Note, *the later* of the two) "affiirmari sentiat animum veras opiniones semper habuisse et tenuisse?" It would be very strange if this criticism were well founded. That Plato propounds, not only in the same dialogue, but in immediate juxta-position, two flatly contradictory theories on an important subject—is what we must not, except on the most distinct evidence, be asked to believe. But what ground is there for the charge of inconsistency? In the earlier passage, the soul, assumed to be immortal, is represented as having been often generated (πολλακις γεγοννια) into new states of being. It is not necessary to restrict the word πολλακις to any definite number of times. The circumstance, that the frequent generation spoken of is viewed as a consequence of the soul's immortality, leads us rather to suppose that an unlimited series of generations is intended. Now, the doctrine that the human soul has undergone an unlimited series of generations in time past, has been shewn to be necessarily involved in the later passage likewise. Again, according to the earlier passage, the soul, having undergone frequent generation, and passed often to and from Hades, has—thus migrating "in alia atque alia loca"—learned all things (ὀυκ ἐστιν ὁ τι ὀυ μεμαθηκεν). Here we must by no means assume (as Stallbaum appears to have done) that *a learning for the first time* is meant. This, of course, would be irreconcilable with the view brought out in the later passage, that the soul never was without having learned. But Plato says nothing about the soul learning things for the first time. He merely says that the soul during its past existence learned all things; and this is precisely what is taught in the later passage. For while it is there demonstrated that Meno's attendant had learned geometry, and so obtained an acquaintance with that science (ἐιχε και μεμαθηκει) in a former state of being, the remark is added, that the demonstration is applicable, not to a few geometrical propositions merely, but to the whole range of truth (ὁυτος γαρ ποιησει περι πασης γεωμετριας τἀυτα ταυτα, και των ἀλλων μαθηματων ἁπαντων).

The expression τα ἐνθαδε, in the earlier passage, is worthy of notice, as shewing, that, when Plato wrote the *Meno*, he held the opinion that not merely *our apprehensions of eternal and immutable truths*, but also, in part, *our mental representations of absent objects of sense*, are the revival of knowledge which we possessed in a former life. The same thing is apparent from the words ἁτε γαρ της φυσεως ἁπασης συγγενους ὀυσης . . . . ἀυτον ἀνευρειν. The term φυσις, though employed in a wide sense to include what may be termed the universe of abstract truths, cannot be taken as exclusive of the universe of sensible objects; and therefore the import of the sentence is, that, since all things in nature, sensible and supra-sensible, are of kin, the knowledge of any one may reawaken the knowledge which we formerly had (either in this life or in a preceding) of any other. The *Meno* in this respect differs from the *Phaedrus*, where the hypothesis of our possession of knowledge in a former life is advanced solely to account for our apprehensions of eternal and unchangeable truth.

## Note VI.

Ὁτι προσαγορευεις ἀυτα ἀνομοια ὀντα ἑτερω, φησομεν, ὀνοματι. λεγεις γαρ ἀγαθα παντ᾽ ἐιναι τα ἡδεα.—(*Philebus*, § 7. Bekker).

From Stallbaum's remarks, quoted by Bekker, it appears that the word ἑτερω in this passage has greatly perplexed commentators. The solution of the supposed difficulty, which finds most favour with Stallbaum, is, to take ἑτερω ὀνοματι as signifying *improprio nomine*. Should this rendering not be adopted, he would, with Heindorf, change ἑτερω into ἑνι γε τω. I am not able to see any reason either for altering the text, or for departing from the ordinary meaning of ἑτερω. Protarchus has undertaken to defend the position, that pleasure is the *summum bonum*. In opposition to this, Socrates has urged that pleasures are various, some being very unlike others.

Protarchus, though it was with difficulty that he was brought to concede the point, does at last grant in a sort of way that it may be so; and asks,—"Well, what then?" The answer of Socrates (ὁτι προσαγορευεις κ. τ. λ) is in substance:—The admission made has a direct bearing on the question in dispute. For, you call pleasures, which are dissimilar from one another, by a different name (ἑτερω ὀνοματι) from pleasure, namely, by the name *good* (λεγεις γαρ ἀγαθα παντ' ἐιναι τα ἡδεα). Now, had you confined yourself to the single name *pleasure*, you would have been in no difficulty; since, dissimilar as pleasures are, no one can deny that they are all pleasures (το μεν ὀυν μη ὀυχ ἡδεα ἐιναι τα ἡδεα λογος ὀυδεις ἀμφισβητει). But when, though you do not go so far as I do in saying that the mass of pleasures are evil and that some only are good, you acknowledge pleasures to be dissimilar, and nevertheless call them all by this other name of *good* (κακα δ' ὀντ ἀυτων τα πολλα και ἀγαθα δε, ὡς ἡμεις φαμεν, ὁμως παντα συ προσαγορευεις ἀγαθα ἀυτα, ὁμολογων ἀνομοια ἐιναι, τω λογω ἐι τις σε προσαναγκαζοι), you are bound to shew what that is, common to all pleasures, the bad and the good (as I term them) alike, which you express by the term *good* (τι ὀυν δη ταυτον ἐν ταις κακαις ὁμοιως και ἐν ἀγαθαις ἐνον πασας ἡδονας ἀγαθον ἐιναι προςαγορευεις).—Here Protarchus, blinking the real point of his opponent's argument, and seizing hold of the incidental circumstance that Socrates had stated some pleasures to be good and others bad, asks how Socrates could expect him, or any one who had defined pleasure to be *the good*, to admit that any pleasure can be bad (πως λεγεις, ὠ Σωκρατες; ὀιει γαρ τινα κ. τ. λ). Of course, this πως λεγεις of Protarchus was merely a trick of fence; for Socrates had himself indicated that he did not expect Protarchus to agree with him in describing certain pleasures as bad (ὡς ἡμεις φαμεν contrasted with συ προςαγορευεις), nor had he founded his argument upon the idea that pleasures are some good and others bad, but only on the admitted fact that they are dissimilar. The response is therefore directly given: ἀλλ' ὀυν ἀνομοιους γε φησεις ἀυτας ἀλληλαις ἐιναι και τινας ἐναντιας.

The above explanation will shew how utterly at sea Stallbaum is in his criticism. "Seriem disputationis," he says, "si spectamus, sensus requiritur hic: *id certe efficitur, voluptates non esse communi boni nomine appellandas, ut quae saepenumero etiam malae sint*. Quod quum verbis non inesse videtur, varias tantarunt emendationes viri docti." That the *series disputationis* would lead us to expect any such sentiment as that to which Stallbaum gives expression, I utterly deny. Though it was the opinion of Socrates himself that pleasures are often bad (ὡς ἡμεις φαμεν), the reasoning was far from being ripe for the affirmation of this as an established point, on which to base the conclusion, that pleasures ought not to be called indiscriminately *communi boni nomine.* In fact, as has been already brought out, Socrates neither expected nor asked Protarchus to admit that pleasures are in every case bad.

## NOTE VII.

Και παλιν ἐπι την των ἡδονων πηγην ἰτεον. ὡς γαρ διενοηθημεν ἀυτας μιγνυναι, τα των ἀληθων μορια πρωτον, ὀυκ ἐξεγενηθη ἡμιν, ἀλλα δια το πασαν ἀγαπᾶν ἐπιστημην ἐις ταυτον μεθειμεν ἀθροας και προσθε των ἡδονων.—(*Philebus,* § 149. Bekker.)

Stallbaum declares this passage to be "aperte mutilatus." It seems that Heindorf also was troubled in his mind regarding it; for Stallbaum mentions, towards the conclusion of his note on the subject, that, after having committed his own views to writing, he obtained a sight of the "exemplar Platonis Heindorfianum," and found written on the margin over against the passage: "Locus mancus videtur, nec sine libris MSS. explendus." Heindorf's correction of ἐξεγενετο for ἐξεγενηθη, approved by Stallbaum, should probably be received; but I am convinced, in opposition to these eminent men, that no further emendation is necessary.

In order that the passage may be understood, some explanation must be given as to what precedes. It has been proved that neither a life of intellect without pleasure, nor a life of pleasure without intellect, is desirable; but that the life which is to possess the character of *good* in the highest degree must be one in which intellect and pleasure are conjoined. The question then arises: in what way are pleasures, and the various kinds of knowledge, to be mingled together, so as to produce the most desirable life? By a lively representation, Socrates imagines himself standing beside two fountains; the one of Pleasure—a fountain of honey; the other of Intellect—a sober fountain of salubrious water; and, like some ὀινοχοος, he has to compound *the most desirable life* out of the ingredients contained in these fountains. He proceeds with his task as follows.

*a.* First, he asks: Shall every species of pleasure be mingled together with every form of knowledge? ἀρα πασαν ἡδονην πασῃ φρονησει μιγνυντες του καλως ἀν μαλιστ' ἐπιτυχοιμεν; (§ 145).

*b.* It is felt that this might not be a safe procedure; and therefore Socrates, recalling a distinction which had been drawn in a previous part of the dialogue, between pleasures as more or less true, and between forms of knowledge as more or less true, puts the question: ὀυκουν ἐι ταληθεστατα τμηματα ἑκατερας ἰδοιμεν πρωτον ξυμμιξαντες, ἀρ' ἱκανα ταυτα ξυγκεκραμενα τον ἀγαπητοτατον βιον ἀπεργασαμενα παρεχειν ἡμιν, ἡ τινος ἐτι προςδεομεθα και των μη τοιουτων; (§ 146). The construction of this sentence is rather difficult; but Stallbaum appears to be right in observing that ἀρα is to be taken in the sense of ποτερον, and that we must supply before ἐι the expression ὀρθως ἀν ποιοιμεν. The meaning then is: shall we not be doing right, if, commencing by mixing together the truest portions of each of the two classes of knowledge and pleasure, we contemplate the life thus produced, and consider whether it is the most desirable that can be framed, or whether we require to add some ingredients distinct from those already used? Protarchus answers: ἐμοι γουν δοκει δραν ὀυτως—thus assenting to the course of procedure suggested.

*c.* No difficulty is felt in determining that *all the truer forms of knowledge*, in other words, all those ἐπιστημαι which have for their objects eternal and immutable realities, must enter into the life that is to be in the highest degree good, Ἐστω δη τις ἡμιν φρονων ἀνθρωπος ἀυτης περι δικαιοσυνης, ὁ τι ἐστι, κ. τ. λ (§ 147).

*d.* According to the line of investigation proposed (*b*), the question should now have been taken up, whether *all the truer pleasures* must have a place in the most desirable life; but (as will fall to be again noticed) the scheme which was laid down is departed from, and the enquiry is pursued with respect to the *less true kinds of knowledge*. These, it is decided, must be introduced into the ἀγαπητοτατος βιος, no less than the truer; so that no species of knowledge is rejected. ΠΡΩ. Ὀυκουν ἐγωγε ὀιδα, ὠ Σωκρατες, ὁ τι τις ἀν βλαπτοιτο πασας λαβων τας ἀλλας ἐπιστημας, ἐχων τας πρωτας. ΣΩ. Μεθιω δη τας ξυμπασας ῥειν ἐις την της Ὁμηρου και μαλα ποιητικης μισγαγκειας ὑποδοχην; ΠΡΩ. Πανυ μεν ὀυν μεθεινται (§§ 148, 149).

(*e.*) *Pleasures* fall next to be disposed of (και παλιν ἐπι την των ἡδονων πηγην ἰτεον. § 150.) The term παλιν need not create difficulty.

The investigation had commenced (*a*) with the enquiry whether all pleasures were to be mixed with all kinds of knowledge; but the question in this form was departed from; and, the fountain of pleasure being for a time left out of view, attention was confined to the fountain of knowledge. Now, however, that a decision has been given regarding knowledge in all its grades, "let us" (says Socrates) "go back to the fountain of the pleasures."—The real knot which interpreters have found in the passage is what follows, where Socrates is (it is supposed) made to say that certain pleasures have already been mixed into the life that is being compounded: a thing which, in fact, has not been done. Stallbaum's words are: "Loquitur nunc Socrates de voluptatum mixtione tanquam jam peracta, quum antea nonnisi de scientiarum atque artium ad vitam beatam necessitate disseruerit. Enimvero si quis verba ὥς γαρ διενοηθημεν ἀυτας μιγνυναι κ. τ. λ. ut sensus flagitat, ad ἐπιστημας referat, repugnabit huic rationi grammatica verborum structura; sin vero illa ad ἥδονας trahas, ut ipsa constructionis natura fert, exacerbati tibi reclamabunt Socratis manes, qui non passuri sint, virum sapientissimum ea, quae nondum facta sunt, jam facta dicere." Most astonishing criticism! What do the words ὥς γαρ κ. τ. λ. really affirm? Not that pleasures of any description had already been mixed into the life that was being compounded, but that Socrates and Protarchus had entertained the thought (διενοηθημεν ἀυτας μιγνυναι) of introducing them at a certain stage, not indeed in the gross, but the true pleasures first (τα των ἀληθων μορια πρωτον). This thought or purpose *had* been entertained (*b*); but (*d*) it had not been carried into effect: a circumstance to which Socrates immediately adverts, in the words ὀυκ ἐξεγενετο ἥμιν. He, moreover, jestingly assigns as the reason which had rendered it impossible for him to carry out the order of investigation originally agreed upon, his love for all the modes of knowledge (ἀλλα δια το πασαν ἀγαπᾶν ἐπιστημην ἐις ταυτον μεθειμεν ἀθροας και προσθε των ἥδονων).

Can anything be more natural and easy than the above interpretation? In my humble opinion, with the single substitution of ἐξεγενετο for ἐξεγενηθη, the passage may remain unaltered, and yet the Shade of Socrates rest in peace.

# MATERIALS FOR A FAUNA CANADENSIS.

[*Continued from page* 461.]

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## Ord. NEUROPTERA. Fam. PHRYGANEIDA (Caddis-flies.)

WE adopt here, not without hesitation, the sub-divisions given by Hagen, in the valuable synopsis of American *Neuroptera* prepared by him for the Smithsonian Institution, and published in the *Smithsonian Miscellaneous Collections*, from which work we have selected the species likely to be met with in Canada. We have thrown the characters of the sub-families and genera into a tabular form for the convenience of the student. It will be observed that the first division for the determination of the sub-families supposes our possession of specimens of both sexes. Where this is not the case, the characters immediately marking the sub-families will in general remove doubt. Thus, if the specimen be a female, having therefore always five articulations to the maxillary palpi, and having three ocelli, the latter character excludes two sub-families. Among the remainder, the structure of the last articulation will distinguish *Hydropsychina;* and if our specimen is not found to belong to this sub-family, the *Rhyacophilinae* would be without transverse nervures to the anterior wings, and the shape of these wings would distinguish *Limnophilina* from *Phryganeina.* We have added auxiliary characters to those given by our author, in order to remove the difficulty here noticed. Another change we have ventured to make. As in other branches of Zoology the terminations in *ida* or *idae* mark the greater families, and those in *ina* or *inae* the sub-families, we have thought it convenient to follow this rule in Entomology also, the deviation from it being, we presume, accidental, and supported by no reason.

## TABLE OF SUB-FAMILIES.

**PHRYGANEIDA** — Maxillary palpi always five in females
- differing in the sexes — ocelli
  - three — max. palpi much longer than the labial: wings with transverse nervures
    - 4 articulate in males. Spurs 2, 4, 4 ........ *Phryganeina.*
    - 3 articulate in males; anterior wings rather narrow, the apex obliquely truncated or rounded .... *Limnophilina.*
  - none. Wings without transverse nervures, palpi pilose, maxillary shorter, or not longer than the labial ........ *Sericostomina.*
- alike in the sexes
  - elongated, hirsute, last joint moveable; antennae setaceous, long, or very long; ocelli none ........ *Leptocerina.*
  - last joint very long, filiform, subdivided; ocelli 3 or none; anterior wings without transverse nervures; posterior folded ........ *Hydropsychina.*
  - last joint entire, straight, shorter than the rest; anterior wings without transverse nervures: posterior not folded ........ *Rhyacophilina.*

### Genera of PHRYGANEINA.

Anterior wings
- naked or nearly so, rather broad, apex ovate, antennae shorter than the wings ........ *Neuronia.*
- pilose, antennae robust, as long as the wings ........ *Phryganea.*

### Genera of LIMNOPHILINA.

Spurs on the tarsi
- 1, 3, 4 — apex of anterior wings
  - truncated ........ *Limnophilus*, Leach.
  - elliptical ........ *Anabolia*, Stephens.
- 1, 3, 3 ........ *Hallesus*, Stephens.
- 1, 2, 2 ........ *Enoicyla*, Rambur.
- 1, 2, 4 ........ *Apatania*, Kolenati.

### [Genera of SERICOSTOMINA.

Spurs on the tarsi
- 2, 2, 4. Max. palpi masking the face, recurved ........ *Notidobia*, Stephens.
- 2, 3, 3 ........ *Brachycentrus*, Curtis.
- 2, 4, 4 ........ *Mormonia*, Stephens.
- 2, 2, 2 ........ *Dasystoma*, Rambur.
- male, 0, 3, 4; fem., 0, 2, 4 ........ *Hydroptila*, Dalman.

### Genera of LEPTOCERINA.

| Spurs on the tarsi | |
|---|---|
| 2, 4, 4 | *Molanna*, Curtis. |
| 2, 2, 2 | *Leptocerus*, Leach. |
| 0, 2, 2 | *Setodes*, Rambur. |

### Genera of HYDROPSYCHINA.

| Spurs on the tarsi | ocelli | | |
|---|---|---|---|
| 2, 2, 4. Ocelli none; antennae extremely long; second joint of max. palpi longer than first; fifth extremely long; intermediate feet of female dilated | | | *Macronema*, Pictet. |
| 2, 4, 4 | none | second joint of max. palpi long; fifth equal to the sum of all the others | *Hydropsyche*, Pictet. |
| | | second, third, and fourth joints of max. palpi equal, longer than first; wings rather acute, narrow | *Psychomyia*, Latreille. |
| | | third joint of max. palpi longer than the other, almost equal to the fifth | *Tinodes*, Stephens. |
| | 3 | | *Philopotamus*, Leach. |
| 3, 4, 4. Ocelli none; antennae thick, rather short; intermediate feet of female dilated | | | *Polycentropus*, Curtis. |

### Genera of RHYACOPHILINA.

| Spurs on the tarsi. | | | |
|---|---|---|---|
| 3, 4, 4. | Ocelli 3 | | *Rhyacophila*, Pictet. |
| 2, 4, 4. | Ocelli | none; palpi densely pilose; first joint of the antennae thick, pilose | *Beraea*, Stephens. |
| | | three; basal joint of max. palpi short; the others longer, equal | *Chimarrha*, Leach. |

## SYNOPSIS OF SPECIES NOT UNLIKELY TO OCCUR IN CANADA.

### Subfam. PHRYGANEINA.

### Gen. NEURONIA. Leach.

N. IRRORATA, *Gmelin.*—Rufous, shining; antennae blackish-piceous, the basal joint rufous within; head and thorax clothed with white hairs; feet luteous, with black spines; abdomen testaceous; anterior wings whitish hyaline densely, transversely irrorated with fuscous; posterior wings hyaline, the apex spotted with fuscous, the anterior margin with a medial, larger, fuscous spot. Length 18 millim.; alar expanse 32 millim. Red River, Rupert's Land, and far South.

N. PARDALIS, *Walker.*—Black, clothed with luteous hair, beneath luteous; anterior femora ferruginous; anterior wings confertly pointed with luteous spots [confluent in the males]; posterior wings anteriorly pointed with luteous, and with a broad luteous sub-apical band. Length 27 millim.; alar expanse 50 millim. Nova Scotia.

N. OCELLIGERA, *Walker*.—Black, with pale hair; tibiae piceous; wings testaceous, the anterior ones reticulated and dotted with black. Length 26 millim.; alar expanse 28 millim. Nova Scotia.

N. SEMIFASCIATA *Say*.—Fulvous; antennae annulated with fuscous, the apex fulvous; head fuscous; dorsum of the mesothorax each side black; head and thorax partly ciliated with black; feet with brown spines; wings fulvous, the veins obscurer, the anterior ones transversely flecked with brownish-black, a small basal spot, and an abrupt medial streak at the posterior margin, brownish black, the disk with two yellowish points; posterior wings with the apical margin hardly irrorated with fuscous, having a short fuscous sub-apical band.

*Male:* Having the dorsal lamina elongated, the sides involuted, the apex with two long spines; superior appendages larger than the lamina; ventral lamina 4-toothed.

*Female:* Ventral lamina shining, the base brownish-black, very much narrower at the apex, recurved, bifid. Length 23–28 millim.; alar expanse 44–52 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston), Nova Scotia, Ohio, Pennsylvania Massachusetts, New York, &c.

N. POSTICA, *Walker*.—Fulvous; antennae annulated with fuscous, the apex fulvous; head and thorax fuscous, with fuscous hair; feet with fulvous spines; wings fulvous, veins of the same colour; the anterior ones transversely irrorated with fuscous, a small basal spot and an abrupt streak upon the middle of the posterior margin, fuscous; disk, with two whitish points; hind wings with an angulated, subapical, fuscous band.

*Male:* Having the dorsal lamina elongated, the apex narrower, incised; superior appendages with a longer lamina; the ventral lamina bidentate.

*Female:* Ventral lamina shining, middle of the base brownish-black, each side ciliated with fulvous, the apex narrow, recurved, entire; each side with a rather long anal palpus. Length 28 millim.; alar expanse 52 millim.

Massachussetts, Pennsylvania, and North Red River, Rupert's Land; also Southward.

N. OCELLIFERA, *Walker*.—Fulvous; antennae shorter, fuscous; thorax ciliated with fuscous gray; wings short, fulvous, veins of the same colour; anterior wings a little transversely irrorated with fuscous, a medial spot upon the posterior margin fuscous; disk with two whitish points; posterior wings with an angulated band, which is subapical, fuscous; feet with gray spines.

*Male:* Dorsal lamina long, acute, ensiform, bifid, superior appendages shorter than the lamina; ventral lamina bidentate.

*Female:* Ventral lamina shining, middle of the base fuscous; the apex narrower, recurved bi-impressed, ciliated. Length 20 millim.; alar expanse 40–42 millim.

N. Illinois; N. Red River, Rupert's Land (Kennicott); Ohio,

### Gen. PHRYGANEA. Linn.

PHR. CINEREA, *Walker*.—Testaceous, striped above with cinerous; apex of the anterior tibiae, and tips of the joints of the anterior tarsi black; anterior wings fuscous, densely dotted with cinerous; posterior wings fusco-cinerous. Length 26-28 millim.; alar expanse 48–54 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

## Subfam. LIMNOPHILINA.

### Gen. LIMNOPHILUS. Leach.

§ 1. Posterior wings with the middle of the hind margin emarginated.

L. PERPUSILLUS, *Walker*.—Testaceous, with testaceous hair; antennae fulvous; anterior wings narrow, the apex subacuminate, subtestaceous, posteriorly and the apex obscurely dotted; veins fulvous; posterior wings whitish. Length 7 millim; alar expanse 13 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

§2. Anterior wings narrow, the apex broader, obliquely truncated.

L. RHOMBICUS, *Linn.*—Ochreous, with luteous hair, antennae luteous; thorax luteo-fuscous; feet luteous; tibiae with yellow, tarsi with black spines; anterior wings ochreous, rufous posteriorly, with a large discoidal, oblique, rhombical spot, and another not well defined about the anastomosis, subhyaline; posterior wings hyaline, the apex subflavescent.

*Male:* Posterior wings underneath with a subapical fuscous fringe; superior appendages oblong, the apex and beneath a little emarginated, with black teeth. Length 23 millim.; alar expanse 44 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston), Europe and Asia.

L. DOSSUARIUS, *Say.*—Pale ochreous; antennae fuscous; abdomen obscure, apex of the segments pale; anterior wings whitish-yellow, veins black; some transverse, sometimes dilated, lines, a pterostigmatical, quadrangular spot, and an anal one, black; posterior wings with two costal spots, and the margin obscure. Length 11 millim.; alar expanse 22 millim.

Salem, Mass.

L. EXTERNUS, *Hagen.*—Luteous; head and thorax obscure above, with luteous hair; antennae with the base luteous; feet ochreous, with black spines; apex of the abdomen obscurer; anterior wings shining, narrow, sub-luteo-pilose, luteous, densely dotted with fuscous, the marks often confluent; a rhombical spot upon the middle, which is oblique, narrow, hyaline; the anterior margin immaculate; at the anastomosis a few spots; veins luteous, the fourth apical areole narrow at the base, shorter than the rest; posterior wings luteo-hyaline.

*Female:* The four anal appendages almost equal, short, acute; the valvule short, incised. Length 20 millim.; alar expanse 38 millim.

N. Red River, Rupert's Land (Kennicott.)

L. HYALANUS, *Hagen.*—Pale ochreous, with yellow hair; antennae ochreous; feet pale, with black spines; anterior wings pale ochreo-hyaline, somewhat glossy, veins ochreous; the fourth apical cellule acute at the base; posterior wings pale yellowish hyaline.

*Male*: Superior appendages ovate, prominent; the inferior ones broadly acute. Length 12 millim.; alar expanse 22 millim.

N. Red River, Rupert's Land (Kennicott.)

### § 3.

L. DESPECTUS, *Walker.*—Greyish-ferrugenous, with pale pile, and longer hair, which is black; antennae subfuscous, bases of the articulations testaceous; maxillary palpi fuscous, labial palpi testaceous; abdomen and feet testaceous; mesothorax with a double whitish streak above; anterior wings fuscous, freckled with whitish; thyridium and first subapical areole with a whitish spot; costa and disk towards the apex still more whitish; posterior wings whitish. Length 11 millim.; alar expanse 21 millim.

Nova Scotia.

L. MULTIFARIUS, *Walker.*—Black, with pale hair, and longer pile, which is black; antennae fuscous, annulated with testaceous; feet testaceous; anterior wings fuscous, freckled with whitish; thyridium and base of the apical areole spotted with white; posterior wings cinerious. Length 11 millim.; alar expanse 21 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

L. INDIVISUS, *Walker.*—Pale testaceous; antennae a little obscure; anterior wings subtestaceous, subtuberculated, veins testaceous, pterostigma subfuscous; posterior wings hyaline. Length 15 millim.; alar expanse 28 millim.

Nova Scotia.

L. SUBGUTTATUS, *Walker.*—Testaceous with pale hair; base of the anterior wings, margin behind, and apex subguttated with whitish, a fuscous spot at the pterostigma, which is broadly surrounded with hyaline; posterior wings subhyaline. Length 12 millim.; alar expanse 23 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

L. PLAGA, *Walker.*—Testaceous, with pale hair, and longer black pile; anterior wings pale testaceous, a large, subquadrate, fuscous spot behind the middle; the apex subreticulated with fuscous, and with two patches of fuscous. Length 13 millim.; alar expanse 21 millim.

Nova Scotia.

### § 4.

L. BIMACULATUS, *Walker.*—Testaceous, with pale hair and longer black pile; antennae ferruginous; thorax bivittated with piceous; anterior wings obsoletely irrorated with pale, especially at the base; posterior wings whitish. Length 19 millim.; alar expanse 34 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

### Gen. ANABOLIA. Stephens.

A. SORDIDA, *Hagen.*—Rufo-fuscous, with black hair; antennae fuscous; head and disk of the thorax rufous; feet rufo-fuscous, with black spines, the tibiae obscurer exteriorly; anterior wings soiled-luteous, densely pointed with fuscous, almost naked, finely rugulose, thyridium pale ; elevated veins smooth, fuscous, the apex partly interrupted with luteous ; posterior wings fusco-hyaline.

*Male :* Superior anal appendages long, laminated, the apex a little oblique ; inferior appendages acute, a little shorter, oblique. Length 18 millim ; alar expanse 35 millim.

N. Red River, Rupert's Land ; Northern Illinois.

A. PUNCTATISSIMA, *Walker.*—Testaceous, broad ; antennae stout ; anterior wings broad, finely rugulose, closely freckled with whitish, the anterior margin almost whitish ; a spot upon the middle, and the thyridium whitish ; posterior wings whitish. Length 13 millim. ; alar expanse 25 millim.

Nova Scotia.

A. MODESTA, *Hagen.*—Nigro-piceous, with black hair ; antennae black, narrowly annulated with luteous ; feet luteous, with black spines, femora piceous ; anterior wings obtuse at the apex, fuscous, almost naked, subrugulose, sparingly irrorated with luteous, veins fuscous ; posterior wings fusco-hyaline.

*Male :* Superior anal appendages laminated, the apex incurved. Length 14 millim. ; alar expanse 26 millim.

Labrador.

### Gen. HALLESUS. Stephens.

H. HOSTIS, *Hagen.*—Luteo-rufous, with luteous hair ; antennae stout, luteous ; thorax on each side above rufo-fuscous ; feet luteous, with black spines ; apex of the wings broader, pale luteo-hyaline, hardly with luteous hairs ; subrugulose, base at the anal angle, and the third apical vein fuscous ; a large oblique paler spot upon the middle ; veins luteous ; posterior wings luteo-hyaline.

*Male :* Posterior appendages short, luteous, ovate, adpressed ; the intermediate ones longer, straight, conical, fuscous. Length 20 millim. ; alar expanse 36 millim.

N. Red River, Rupert's Land ; Northern Illinois.

H. GUTTIFER, *Walker.*—Testaceous ; antennae ferruginous ; anterior wings tuberculose, with an obsolete subfuscous spot in the apical areolets, another at the thyridium, and a black dot in the third apical areolets, posterior wings whitish ; feet and palpi testaceous.

*Male:* The fuscous spots of the anterior wings sometimes obsolete. Length 20 millim. ; alar expanse 36-42 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston), Georgia (Abbott), New Orleans.

H. MUTATUS, *Hagen.*—Fuscous, with fuscous hair; antennae brown, annulated with luteous; feet yellowish, with black spines, base of the tibiae as well as the middle and apex marked with fuscous; wings fuscous, finely tuberculated, closely guttated with pale; a semicircular stripe at the anastomosis apically, and a discoidal irregular spot, pale hyaline; veins fuscous; posterior wings brownish hyaline. Length 15 millim.; alar expanse 29 millim.

Labrador.

### Gen. ENOICYLA. Rambur.

E. AREOLATA, *Walker.*—Black-gray, with black hair; femora obscure ferruginous; anterior wings whitish, with black veins, many of the areoles with fuscous bands, the apical ones with broader bands; margins ciliated. Length 7 millim.; alar expanse 13 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

E. INTERCISA, *Walker.*—Fuscous with white hair; antennae fuscous annulated with luteous; feet luteous, with black spines; spurs short; anterior wings long, narrow, fuscous, subtuberculose, with white hair, with a discordal oblique spot, the thyridium and a point at the margin of each apical areole, whitish hyaline; veins lurid; posterior wings grayish hyalime.

*Var.:* Black, antennae and feet ferruginous; thorax striped with hoary; anterior wings fuscous, irrorate with whitish, with some oblong darker brown and whitish discoidal spots, and with small white spots at the apex; posterior wings grayish. Length 18 millim.; alar expanse 34 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

E. DIFFICILIS, *Walker.*—Testaceous with pale hair; antennae fuscous, the two basal joints entirely and the base of the following ones testaceous; anterior wings subtestaceous, closely but indistinctly irrorated with hyaline, spots often confluent, veins ferruginous; posterior wings hyaline. Length 15 millim.; alar expanse 28 millim.

Nova Scotia.

E. DESIGNATA, *Walker.*—Fuscous with luteous hair; antennae lurid; thorax above bivittated with lurid; abdomen luteous beneath;

feet yellow, with black spines, spurs long, luteous; anterior wings luteous, almost shining, with a longitudinal stripe which is broader towards the apex, and margined with fuscous; veins luteous; posterior wings luteo-hyaline. Length 18 millim.; alar expanse 34 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston), Nova Scotia, Arctic America.

### Gen. APATANIA. Kolenati.

A. NIGRA, *Walker.*—Black, with black pile; beneath, a little clothed with luteous hair; antennae rather short; breast grayish; apices of the abdominal segments, base of the tarsi, and tibiae ferruginous; wings blackish, clothed with black pile. Length 9 millim; alar expanse 16 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

A. PALLIDA, *Hagen.*—Black, with luteous pile; antennae black; feet pale, with black spines, femora fuscous; anterior wings luteo-hyaline, and the veins of the same colour, with luteous pile and cilia; posterior wings hyaline. Length 8 millim; alar expanse 15 millim.

St. Lawrence River.

### Subfam. SERICOSTOMINA.

Species of Sericostoma (Latreille) are found in the Southern United States, but are scarcely to be expected in Canada.

### Gen. NOTIDOBIA. Stephens.

N. BOREALIS, *Hagen.*—Brownish-black, with luteous hair; antennae bright yellow, the last joint and the palpi black, hairy; feet pale, whitish; wings fusco-hyaline, the anterior wings densely covered with luteous hair and ciliated with luteous. Length 7 millim.; alar expanse, 13 millim.

St. Lawrence River; Washington.

### Gen. BRACHYCENTRUS. *Curtis.*

B. FULIGINOSUS, *Walker.*—Black, with hoary hair; antennae long, ferruginous; apices of the abdominal segments and the legs testaceous; palpi testaceous, with the apex blackish; the anterior wings grayish-fuscous, veins ferruginous; posterior wings cinereous. Length 14 millim.: alar expanse 26 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

### Gen. Mormonia. Stephens.

M. togata, *Hagen.*—Brownish-gray, with luteous hair; antennae pilose, pale yellow, annulated with fuscous, the basal joint long, brownish-gray, hairy; palpi and feet pale; abdomen fuscous; anterior wings narrow, fuscous with luteous hair, veins fuscous, with fuscous pile; posterior wings cinereous. Length 9 millim; alar expanse 16 millim.

St. Lawrence River; Washington.

### Gen. Hydroptila. Dalman.

H. tenebrosa, *Walker.*—Blackish; antennae fuscous, the basal joint larger, ovate; feet testaceous; wings blackish-gray, ciliated, with black veins. Length 4 millim; alar expanse 6 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

H. albicornis, *Hagen.*—Gray; antennae stout, snow-white, with the middle and apex fuscous; palpi whitish; head with snow-white hair, the vertex with fuscous hair; thorax fuscous; feet whitish, the posterior ones ciliated with white; anterior wings greyish-fuscous, ciliated with gray, the margin and disk pointed with snow-white; posterior wings gray, clothed and ciliated with gray hair. Length 3½ millim.; alar expanse 6 millim.

St. Lawrence River, Canada.

H. tarsalis, *Hagen.*—Gray; antennae somewhat robust, rather long, fuscous with gray hair; palpi black, the apex snow-white; head black, the vertex white; thorax fuscous: feet whitish, anterior tibiae, spurs, and tarsi fuscous, the latter annulated with white; posterior feet with gray cilia; anterior wings fuscous, the anterior margin black, ciliated with gray, and pointed with snow-white; posterior wings with gray hairs and cilia. Length 3 millim.; alar expanse 5½ millim.

St. Lawrence River, Canada.

The specimen described of the preceding being a female, of this a male, from the agreement in size and locality, and in several characters, Hagen not improbably suggests that these may be the two sexes of one species.

## Subfam. Leptocerina.

### Gen. Molanna. Curtis.

M. cinerea, *Hagen.*—Ferruginous, sparingly clothed with gray hair; antennae stout, ferruginous; anterior feet ferruginous, the four posterior gray, the tarsi with black spines; wings narrow, gray, clothed with gray hair, the apex obsoletely marmorated with fuscous; posterior wings gray. Length 12 millim.; alar expanse 23 millim.

St. Lawrence River, Canada.

M. RUFA, *Hagen.*—Rufo-fuscous, with fuscous hair; antennae and palpi rufous; feet testaceous, the anterior ones and femora rufous; abdomen fuscous; wings fuscous, with rufous hair, posterior wings fuscous, veins fuscous. Length 10 millim.; alar expanse 18 millim.

Trenton Falls, N. Y.

### Gen. LEPTOCERUS. Leach.

L. LUGENS, *Hagen*—Fuscous; antennae black, the basal half annulated with snow-white; palpi fuscous; head with snow-white hair; feet snow-white, base of the femora fuscous, the four anterior tarsi spotted with fuscous; anterior wings rufo-fuscous, with fuscous hair, and luteous intermixed, a whitish-yellow spot at the anal angle; veins fuscous; cilia paler; posterior wings gray. Length 11 millim.; alar expanse 21 millim.

St. Lawrence River, Canada.

L. DILUTUS, *Hagen.*—Grayish-fuscous; antennae fuscous, the basal half broadly annulated with snow-white; palpi fuscous, with snow-white hair; head with snow-white hair; feet snow-white, bases of the femora a little obscured; abdomen fuscous; anterior wings gray, with luteous hair, sometimes obsoletely varied with fuscous; veins gray; cilia fuscous, with an anal yellowish spot; posterior wings gray. Length 7-10 millim.; alar expanse 13-19 millim.

Chicago.

L. NIGER (*Phrygania nigra, Linn.*)—Black, shining, with black hair; antennae black, the basal half annulated with snow-white, the basal joint rufous; head black, shining; palpi very densely black hirsute; abdomen black; feet luteous, intermediate ones snow-white; tarsi spotted with fuscous; anterior wings steel-blue black, posterior wings blackish. Length 7½ millim.; alar expanse 14 millim.

Washington; Europe, widely distributed.

L. SEPULCHRALIS, *Walker.*—Black, with black hair; antennae black, the base annulated with white; apex of the abdomen ferruginous; feet testaceous; wings blackish. Length 8 millim.; alar expanse 13 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

L. VARIEGATUS, *Hagen.*—Luteo-fuscous, with snow-white hair; antennae luteo-fuscous, the basal half annulated with snow-white, the basal joint luteo-fuscous; palpi fuscous, with gray hair; head fuscous, sparingly clothed with white hair; feet gray, tarsi snow-white, spotted with fuscous; anterior wings grayish fuscous, with brown and gray hair, spotted with gray especially at the apex, margin, and angle; veins stout fuscous; posterior wings cinereous. Length 14 millim.; alar expanse 27 millim.

Chicago.

L. SUBMACULA, *Walker.* 4Black, with black hair; antennae very long; palpi hairy; tibiae and tarsi testaceous; wings cinereous, the anterior sprinkled with white, and with three whitish spots, the one basal, the second discoidal subcostal, and the third anal; veins black. Length 14 millim.; alar expanse 25 millim.

St. Lawrence River, Canada.

L. MENTIENS, *Walker.*—Ferruginous, hairy; antennae black, annulated with white; palpi hairy; tarsi banded with white; anterior wings cinereo-fuscous, with ferruginous pubescence, veins ferruginous; posterior wings cinereous. Length 10 millim.; alar expanse 19 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

L. INCERTUS, *Walker.*—Obscure testaceous, with golden hair, and more scarce black pile; beneath whitish; antennae very long, whitish; palpi hairy; apex of the abdomen ferruginous; feet whitish; wings cinereous, the anterior with golden pubescence. Length 7 millim.; alar expanse 12 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

L. INDECISUS, *Walker.*—Black, with black hair; feet ferruginous; antennae very long, palpi very hairy; wings blackish, the anterior with fuscous pubescence. Length 11 millim.; alar expanse 21 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

### Gen. SETODES. Rambur.

S. EXQUISITA, *Walker.*—Pale yellow, with snow-white hair; antennae luteous, the lower part annulated with fuscous, the basal joint yellow, with snow-white hair; head and thorax yellow, with snow white hair; palpi and abdomen yellow; feet snow-white; anterior wings snow-white, with some transverse luteous bands, the apical ones maculose, imperfect; at the apex of the posterior margin are four black spots and some obsolete black streaks; posterior wings snow-white. Length 8-13 millim.; alar expanse 15-25 millim.

St. Lawrence River, Canada; Washington; Georgia.

S. NIVEA, *Hagen.*—Brownish-black, with snow-white hair; antennae snow-white, the lower part annulated with fuscous, the basal joint yellow, with snow-white hair; head yellow, the disk brownish-black, with snow-white hair; thorax brownish-black, with snow-white hair; palpi and feet pale; abdomen luteous; anterior wings snow-white, with fuscous veins, at the apex transversely obsoletely clouded; posterior wings snow-white. Length 15 millim.; alar expanse 28 millim.

St. Lawrence River, Canada.

S. RESURGENS, *Walker.*—Fuscous with whitish hair; palpi and feet fulvous, sprinkled with whitish hair; anterior wings fuscous, with white spots at the base and at the disk and apex of the apical areoles; posterior wings cinereous. Length 16 millim.; alar expanse 30 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

S. ALBIDA, *Walker.*—Fuscous, with whitish hair; lower part of the antennae annulated with white; palpi testaceous; feet whitish; wings whitish, with testaceous veins. Length 13 millim.; alar expanse 25 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

S. INJUSTA, *Hagen.*—Luteous, with luteous hair; antennae luteous, subannulated with fuscous; palpi with luteo-fuscous pile; feet and abdomen pale luteous; anterior wings luteous, with ochreous pile and cilia, the anterior margin a little obscurer at the base; the anal angle a little fuscous and ciliated with fuscous hair; posterior wings luteous, with pale cilia. Length 12 millim.; alar expanse 23 millim.

St. Lawrence River, Canada; Chicago.

S. IMMOBILIS, *Hagen.*—Fuscous with luteous hair; antennae fuscous, the basal joint luteous; palpi with fuscous hair; head and thorax fuscous; feet luteous; abdomen fuscc-luteous; anterior wings fuscous, with luteous hair, the margin obsoletely spotted with fuscous, ciliated with fuscous; posterior wings brown-gray, with gray cilia. Length 7 millim.; alar expanse 13 millim.

St. Lawrence River, Canada.

### Subfam. HYDROPSYCHINA.

### Gen. MACRONEMA. Pictet.

M. ZEBRATUM, *Hagen.*—Brassy-fuscous, spotted with yellow; antennae black; head, thorax, and abdomen brassy-fuscous; palpi yellow; feet yellow, the anterior tibiae and base of the femora a little infuscated; posterior tibiae with long yellow spines; anterior wings subnude, yellow, with longitudinal stripes at the base, and transverse ones on the disk fuscous; the apex fuscous, with an orbicular yellow spot; posterior wings cinereous, the anterior margin and pterostigma yellow.

*Var.:* Anterior wings less spotted, the basal stripes shorter, the disk spotted, and the apex with an incurved band, which has the open side inwards, fuscous.

St. Lawrence River, Canada; Niagara Falls; Maryland; Virginia; Washington.

### Gen. HYDROPSYCHE, Pictet.

H. SCALARIS, *Hagen.*—Black-gray, with white hair; antennae luteous, the lower part obliquely striated with black, the first joint with snow-white hair; head grayish-fuscous, with snow-white hair; thorax grayish-fuscous, with a broad medial stripe of white hair; the eyes of the male larger, approximated; palpi luteo-fuscous; abdomen fuscous; feet pale luteous; anterior wings blackish-gray, densely flecked with white; veins black; posterior wings cinereous, luteous at the base. Length 13 millim.; alar expanse, 25 millim.

St. Lawrence River, Canada; Washington.

H. MOROSA, *Hagen.*—Luteo-fuscous, with luteous hair; antennae luteous yellow, annulated with fuscous; head and thorax luteo-fuscous, with luteous hair; feet luteous; abdomen fuscous; anterior wings luteo-fuscous, densely guttated with luteous; veins luteo-fuscous; posterior wings luteo-cinereous. Length 10-13 millim.; alar expanse 19-25 millim.

St. Lawrence River, Canada; N. Red River, Rupert's Land; Trenton Falls, N. Y.; Washington.

H. PHALERATA, *Hagen*.—Fuscous, with luteous hair; antennae fuscous, annulated with luteous; palpi and feet luteous; head and thorax fuscous, with luteous hair; anterior wings fuscous, guttated with luteous, with larger spots at the base, pterostigma, and anal angle; veins fuscous; posterior wings blackish gray. Length 7-10 millim.; alar expanse 13-19 millim.

St. Lawrence River, Canada; Pennsylvania; Washington.

H. ALTERNANS, *Walker*.—Black, with hoary hair; base of the antennae fulvous, as well as the feet and apices of the abdominal segments; anterior wings fuscous, closely irrorated with hoary; posterior wings cinereous. Length 12 millim.; alar expanse 23 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

H. INDECISA, *Walker*.—Blackish, beneath testaceous; antennae testaceous, annulated with fuscous; palpi testaceous, fulvous at the base; feet testaceous; anterior wings cinereous, closely guttated with yellow. Length 12 millim.; alar expanse 23 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston); Nova Scotia.

H. MACULICORNIS, *Walker*.—Blackish, hairy; antennae testaceous, annulated with fuscous; palpi pale; pectus ferruginous; feet testaceous; anterior wings fusco-cinereous, with obsolete irrorations; posterior wings cinereous. Length 8 millim; alar expanse 15 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

H. CHLOROTICA, *Hagen*.—Pale ochreous, with ochreous hair; antennae ochreous at the base, annulated with fuscous, and fuscous at the apex; palpi fuscous; feet luteous; head and thorax luteo-fuscous, with luteous hair; abdomen luteous; anterior wings ochreous, the anal angle and apical margin ciliated with fuscous; posterior wings cinereous. Length 10-12 millim.; alar expanse 19-23 millim.

St. Lawrence River, Canada; N. Red River, Rupert's Land; Chicago; Trenton Falls, N. Y.

H. SORDIDA, *Hagen*.—Blackish fuscous; antennae and palpi fuscous; head and thorax blackish fuscous, with luteous hair; feet luteo-fuscous, femora fuscous; anterior wings blackish fuscous, with fuscous hair; posterior wings blackish. Length 8 millim.; alar expanse 15 millim.

St. Lawrence River, Canada; Washington.

### Gen. PHILOPOTAMUS. Leach.

P. DISTINCTUS, *Walker*.—Black, with black and yellow hair; antennae much longer than the body; palpi and feet testaceous; anterior wings brownish-gray, closely guttated with yellow. Length 6 millim.; alar expanse 11 millim.

Trenton Falls, N. Y.

### Gen. POLYCENTROPUS. Curtis.

POL. INVARIUS, *Walker*.—Fulvous, with golden hair; vertex and disk of the thorax black; antennae black, the base fulvous; feet testaceous; anterior wings subfuscous, with ferruginous veins; posterior wings cinereous. Length 9 millim.; alar expanse 16 millim.

Nova Scotia.

POL. CREPUSCULARIS, *Walker*.—Black, with luteous hair; antennae testaceous, obsoletely annulated with fuscous, black at the apex; apices of the abdominal segments and legs testaceous; wings cinereous, the anterior with testaceous pubescence, veins fulvous. Length 9 millim.; alar expanse 16 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

POL. CINEREUS, *Hagen*.—Fuscous, with fuscous and whitish hair; antennae fuscous, annulated with white; palpi luteous; head with white hair, occiput with fuscous hair at each side; disk of the thorax with white hair; feet luteo-fuscous, the femora luteous; abdomen fuscous, pale beneath; anterior wings fuscous, with fuscous veins, and closely guttated with white; posterior wings blackish-gray, ciliated with black. Length 8-10 millim.; alar expanse 15-19 millim.

St. Lawrence River, Canada.

### Gen. PSYCOMYIA. Latreille.

PS. FLAVIDA, *Hagen*.—Yellow, with ochreous hair; antennae whitish, with obsolete annulations; palpi and feet whitish; head and thorax luteous; anterior wings yellow, with dense ochreous hair and cilia; posterior wings cinereous, acute, with cinereous hair. Length 5 millim.; alar expanse 9 millim.

St. Lawrence River, Canada; Washington.

### Gen. TINODES. Stephens.

T. LIVIDA, *Hagen*.—Luteous, with gray hair; antennae luteous; palpi luteo-fuscous; feet pale, the anterior ones luteous; head and thorax luteo-fuscous, with luteous hair; anterior wings gray, with gray hair and an anal luteous spot; posterior wings grayish hyaline. Length 8 millim.; alar expanse 15 millim.

St. Lawrence River, Canada.

### Subfam. RHYACOPHILINA.

### Gen. RHYACOPHILA. Pictet.

R. FUSCULA, *Walker*.—Ferruginous, partly with black hair, testaceous beneath; thorax with a subfuscous spot on each side; feet testaceous, apex of the anterior tibiae fuscous; wings cinereous, the anterior ones irrorated with whitish, and with many marginal guttae. Length 13 millim.; alar expanse 25 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

R. TORVA, *Hagen*.—Rufo-fuscous; antennae and palpi rufo-fuscous; head and thorax brownish-black; feet testaceous; abdomen luteous; wings fusco-hyaline, with fuscous veins; anterior ones with dense luteous guttae. Length 10 millim.; alar expanse 19 millim.

Trenton Falls, N. Y.; Washington.

### Gen. BERAEA. Stephens.

B. MACULATA, *Hagen*.—Black, with black hair; antennae yellow, the base, middle, and apex blackish-fuscous; feet whitish, annulated with black; abdomen pale beneath; anterior wings black, with black hair and cilia, with two white, transverse apical lines, and the apex pointed with white, emarginated at the apex; posterior wings black. Length 4 millim.; alar expanse 7½ millim.

St. Lawrence River, Canada.

### Gen. CHIMARRHA. Leach.

C. ATERRIMA, *Hagen*.—Deep black, with black hair; body, antennae, palpi, and feet black, the front with hardly hoary hair; anterior wings with black hair. Length 6–8 millim.; alar expanse 11–15 millim.

St. Lawrence River, Canada; Pennsylvania; Washington; Georgia.

C. OBSCURA, *Walker*.—Blackish, with fuscous hair; thorax and abdomen ferruginous; feet testaceous; antennae black; wings brownish-black, ciliated. Length 4½ millim.; alar expanse 8 millim.

St. Martin's Falls, Albany River, Hudson's Bay (Barnston.)

All through this family, from the great number of species described and the extent of the range of most of them, we have felt much at a loss which to select; and as our own acquaintance with Canadian species is as yet very limited, we could only judge from general considerations. We give our synopsis as a foundation to work upon, expecting that many species may be added to it, and possibly not a few rejected from it, yet hoping that it may be of use.

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# A NOTE ON THE ETYMON OF ONTARIO.

BY THE REV. DR. SCADDING.

*(Read at a Conversazione at Trinity College, May 23rd, 1862.)*

Father Louis Hennepin in his account of a "New Discovery of a vast Country in America, (1679–82) extending above 4000 miles between New France and New Mexico," says, (p. 31, French version,) that among the Iroquois tribes the name *Ontario* has the signification of "Beau Lac," Beautiful Lake; and in another part of his book he says they also call it *Skannadario*, "Fort beau Lac," (p. 42) Skannadario being supposed to be the same name as *Ontario* with a prefix of intensity.

Hennepin's book being not uncommon both in English and French, the statement has been very generally received that the familiar term by which we designate the great sheet of water which forms our southern horizon, signifies "Beautiful Lake." This interpretation did not originate with Hennepin. He probably heard or read of it at Quebec before his visit to the western regions, for we see (p. 63) a similar statement made in Bressani's *Relation Abrégée*, in 1642; and also subsequently in 1663 in a Report of the Baron d'Avangour, a Governor General of Canada, (*Vide* the Colonial History of the State of New York, ix. 16.) We may hence suppose that this interpretation of *Ontario* was the one current at Quebec in Hennepin's time. Still some uncertainty about it is observable, for in a note to an account of De Courcelles' Voyage to Lake Ontario in 1671, the writer professes to explain the term in question as signifying "The

Great Lake"—from the Huron *Iontare* lake and *io* great. While more recently, Schoolcraft (vol. v. 594) has stated that the original appellation of the Lake was *Onontario*, which he conjectures to be compounded of *io*, an exclamation of surprise or delight, *onon* hills, and *dar* rocks. The precise applicability of the epithet thus interpreted is not manifest. The form of the word is also otherwise varied. On a "Plan of the Early Forts on the Richelieu River," given in vol. iii. of the *Relation des Jesuites* it is given as *Ondiara*, and in the "Documentary History of the State of New York," (v. 709) it figures as *Untarie*.

Ontario, outspread in silvery calm, as we often see it, or when reflecting back from its "unnumbered dimples" the pure azure of the heavens, is doubtless beautiful; but so are all our lakes, under similar circumstances. Hence the name, as commonly understood, does not seem to be sufficiently distinctive. Certainly it is not impossible that a word in the Huron and Iroquois dialect, expressive of beauty generally, may have been caught up by some early French explorer, and applied erroneously as a proper name. For popular and poetic purposes "Beautiful Lake" answers well enough; but I think we shall see directly, that a truer and better account of the appellation may be given.

Before proceeding to explain, it may not be uninteresting to mention that our Lake has borne a variety of names. In an "Account of Encroachments of the English on the Territories of New France, 1699," (*Vide* Doct. Hist. N.Y., ix. 702,) it is called the "Lake of the Iroquois." And so also in the Plan of Early Forts above referred to. It has also been called, no doubt locally, Lake Cataraqui, Lake Oswego, (this is said to be the Iroquois appellation) and Lake Neageh. Governor Dongan, of New York, in a communication to Mons. de la Barre, in 1683, styles it, for convenience probably, the Lake of Canada. Once it was known as Lake Frontenac, in honour of the Count de Frontenac, a distinguished Governor General of Canada in 1672, from whom the Fort which formed the original nucleus of Kingston was named, and from whom the County in which Kingston is situated, is still named. On Hennepin's map it is marked "Lac Ontario ou de Frontenac." It has also borne the name of St. Louis; it is so designated in Champlain's map, 1632; and in the map accompanying the *Historia Canadensis*, by the Jesuit du Creux, 1662. In this last mentioned map (which may be seen in Bressani's

"Abridged Narrative of the Jesuit Missions in New France," published in Montreal in 1852,) our Lake figures as *Lacus Ontarius seu S. Ludovici.* But then, in a "Chorographia Regionum Huronum" on a larger scale, given in the corner of the same map, the name appears as *Lacus*—not *Ontarius*—but *Ouentaronius*—a circumstance to which in a few moments I shall draw your especial attention, inasmuch as, I think, we have here a clue to a more legitimate mode of accounting for the word *Ontario* than any of those that have already been described.

Our Lakes generally, have received appellations from tribes inhabiting their borders.

*Erie* is an aboriginal name curtailed and disguised. The French maps give it as *Erié*, with an accent, (said to be softened from *Erigé* or *Eriké*,) and they interpret it to mean *Lac du Chat*, "Cat Lake," from a tribe which speedily disappeared, at least, under that designation, whose totem probably was the lynx or wild cat, or who may thus have been nicknamed by their enemies. In du Creux's map it is *Lacus Erius seu Felis.* So in Hennepin's map it is *Lac Erié ou du Chat.* This appears to have been the Huron name; whilst among the Iroquois it was known as the Lake of the *Tejocharontiong*, (Hennepin) or *Techaronkion*, (de Courcelles.) In Champlain's map Lake Erie does not appear: a rather broad stream connecting Lakes Huron and Ontario occupies its place. In Lewis Morgan's Aboriginal Map (1851) the Lake is marked *Doshoweh Tecarneodi*, evidently a local appellation from *Doshoweh* the name of the entrance to Buffalo Creek, where the city of Buffalo now stands. This Doshoweh is stated by Morgan to mean "Splitting the Fork," although earlier writers, giving the word *Deoseowa*, (Seneca) or *Tehoseroro*, (Mohawk) educe from it the more elegant signification of "Place of the Linden or Basswood tree."

Lake Michigan retains an aboriginal name, having the vague signification of "Great Lake." Hennepin, however, informs us that it possessed also the more distinctive appellation of "Lac des Illinois," derived from the neighboring native tribes. And "Illinois," he assures us, signifies—like the ancient German Teutones,—"people," braves, perhaps, or heroes; so that du Creux, in his Latin map, instead of naming this lake *Magnus Lacus Algonquinorum* as he does, might have termed it *Magnus Lacus Virorum.* (*Algonquinorum* seems to be an error, as the Algonquins, *i.e.*, the Objibwas, &c., were situated farther to the North and West.)

Lake Huron means the "Lake of the Hurons," as it figures on du Creux's map—*Mare Dulce seu Lacus Huronum. Mare Dulce* is evidently the designation given to this lake by Champlain, who, struck by the purity and excellence and vast volume of its waters, called it Mer Douce; while *Huronum* reminds us of one of the mongrel Latinized appellations to be met with in Tacitus; for under an aboriginal guise and sound the term "Huron" is in fact French, being simply a sobriquet for the Wyandots,—derived from "Hure," as Bressani and Hennepin rightly say—and "Hure," Boyer informs us, is a term applied to a *tête d' un sanglier, d' un ours, d' un brochet*, (a great Pike); also he gives it as a coarse term for a *tête mal peignée, cheveux rudes, et mal en ordre.* The Wyandots living on the eastern borders of this lake, were accustomed, it appears, by way of ornament to singe their hair until their heads had the bristly, unkempt aspect of those prefixed to wild boars. Hence the French jestingly applied to them the appellation of "Hurons," Boar-heads, above somewhat amusingly Latinized into *Hurones.* Charlevoix calls this Lake "the Lake of the Attigouotans," (Attigouotan is one of the very varied forms of Wyandot) and Livingston, a United States Secretary for Indian Affairs, in "Observations on a Tour to Onnondaga in 1700," calls it Lake Ottawawa, and Lake Erie, Lake Sweege—examples, again, probably, of local names given to lakes which also bore more general appellations.

Of Lake Superior I do not find given in the maps any specific aboriginal name; but in Baraga's Otchipwe Dictionary I find it named in the usual way from the tribes inhabiting its shores: he styles it *Otchipwe-Kitchigami*, "Sea of the Chippewas." In "Hiawatha," we shall remember, this lake figures as "Gitche-Gumee," conveniently, but not elegantly, translated "Big-sea-water,"—another of those general appellations applicable, and doubtless applied, on certain occasions, to any of the Great Lakes. Here was drowned Chibiabos, the "most-beloved" of Hiawatha: Chibiabos "the sweetest of all singers:"—

> "Unktakee, the god of waters,
> He the god of the Dacotahs,
> Drowned him in the deep abysses
> Of the Lake of Gitche-Gumee." (xv.)

It was probably because this lake was thus haunted, that it was deemed sacred; although, according to the Jesuit Claude Allouez, it may have been for other reasons: "Les Sauvages respectent ce lac comme un Divinité; et lui font des sacrifices, soit à cause de sa grandeur, * * soit à cause de sa bonté, fournissant du poisson, qui nourrit tous ces peuples au defaut de la chasse, qui est rare aux environs," (Rel. 1667–8.) We may congratulate ourselves that this lake did not retain the name "Lake Tracy," which was once conferred upon it in honour of the Marquis de Tracy, a Viceroy of Louis XIV., in 1665,—in whose time Mr. F. X. Garneau (History of Canada, i. 216,) informs us, horses were first imported into Canada. Father Claude Allouez speaks of it under this name (anno 1667), and in the map given by Bancroft in his History of the United States (vol. iii. 153), it is marked *Lac Tracy ou Superieur*. Du Creux simply Latinizes it *Lacus Superior*, which, though denoting vaguely the "Upper Lake," has produced the name which has such a grand sound in our ears, in comparison with which "Lake Tracy" seems a kind of bathos, somewhat similar to that which presents itself on the maps in those very unpoetic designations of two conspicuous peaks of the Rocky Mountains—Mount Brown and Mount Hooker. Champlain gives the name of Lake Superior as *Grand Lac*—a literal translation of *Gitche-Gumee*.

I now return to our own lake and its appellation. I have said that it is generally received to mean *Beautiful;* but on comparing the title borne by this lake in several of the old maps with the name of a celebrated aboriginal tribe once inhabiting its southern shore, and bearing in mind the tendency which has evinced itself in other instances to describe lakes by the names of neighboring tribes, it has struck me that another interpretation of Ontario is more probable; and that its supposed signification of "Beautiful"—if that sense can be traced in its composition at all—is perhaps as fanciful as the discovery of *ἄορνις bird-less,* in the Phœnician *Avernus,* indicating in reality, we are told, nothing relating to "birds," but the gloom and darkness characteristic of a volcanic crater.

Du Creux gives, as I have said, *Lacus Ontarius* and *Lacus Ouentaronius.* Now I think this last term *Lacus Ouentaronius* comes the nearest to the name intended to be expressed by Ontario; that it, in fact, contains the original of Ontario.

On the map given by Brodhead in his History of the State of New York, 1609–1664, the name borne by our lake in 1615 was "Lac des

Entouhonorons,"—Lake of the Entouhonorons. Champlain, also, in his account of his Expedition with the Wyandots against the Iroquois, calls it "The Great Lake of the Entouhonorons."

Now who were these? They were one of the celebrated "Five Nations" inhabiting the region between Lake Ontario and the New England States—the well-known league of tribes called by the French "Iroquois,"—not by the satirical use, this time, of a French term, but by the manufacture of a word out of native materials,—from *hiro,* dixi, "I have said," and *koué,* a French effort to express the favorite formula of assent, given more at large in *Hiawatha,* as "hi-au-ha!"

The Entouhonorons are better known to us as the Senecas. How it happened that a portion of the sons of our far western forests came to possess a name identical with that of the Emperor Nero's respectable tutor, used at one time to be a mystery to me; and its solution, when I discovered it, gave me great delight. The origin of the term I found to be this:—the termination *eca*—variously written *eca, aca, aga, equa,*—according to Pownall,—a learned philological Governor, in succession, of New York, Massachusetts, and South Carolina, about a hundred years ago, (1753–1)—denotes a tribe or people: and *sen* has the meaning of *farther.* Hence *Seneca* signifies "the farther nation," without stating their name. In like manner the familiar term *Mohawk* has, according to the same authority, the meaning of "the hither or nearer nation"—the particle *mo* or *ma* having the sense of *hitherward, hithermost,*—the actual name of these *Mo-acs, Mo-ages, Ma-quas,* &c., being *Ka-ying-e-ha-aga,* "the people that are at the head of men,"—a name compressed by the French into *Agniers.* "Hither" and "farther" are here used relatively, of course, to New England.

The real name of the Senecas or "Farther Tribe," as given on the southern or Iroquois side of the lake, was *Nundowauga* or *Nundawaono,* "the-great-hill-people," from a hill at the head of Lake Canandaigua, where was their original settlement, (Morgan, 51.) But on the northern or Wyandot side they were known as the *Entouhonorons, Sonnontouans,* &c., terms by which perhaps a similar sense may be conveyed, as we know that in the Algonquin dialect, *Onnontio* = Montmagny = Great Mountain. On Champlain's map the Seneca District is marked as occupied by the *Antouhonorons,* and in du Creux's by the *Ondieronii* and *Sonnonionenii.* In *Ondieronii* we may recognize the Iroquois *Nundawa-ono,—ono* and *eronon* in the northern and southern dialects respectively implying "people."

The Wyandots or Hurons, inhabiting the regions where we now find our home—in their hostile expeditions against their hereditary foes and ultimate conquerers, the Five Nations,—had to cross our lake; and the first of these nations upon whom they would descend was this tribe of Entouhonorons, as they would style them. Hence they spoke of the lake which was the highway to the country of their enemies, and which probably at the time bore no general geographical appellation in our sense of the term, as the Lake of the Entouhonorons.

Disguised, then, through the difficulty which the early and generally unphilological European settlers experienced in catching and rendering the exact sounds and syllables of a nasally-pronounced unwritten language, divided into dialects, some admitting, some rejecting, labials and liquids,—do we not see in du Creux's *Lacus Ouentaronius* an effort to express in Latin phrase the "Lake of the Ondierons," as he seems to have caught the sound, (compare his *Ondieronii*) who were plainly the same as the Nundawa-ono, the Sonnontonans, Isonontonans, Antouhonorons, or Entouhonorons? Just as in his *Lacus Erius* he expressed "Lac des Erigés" or "Eriés." And then in this *Ouentaronius,* pronounced according to the French phonetic system, do we not detect *Ontario?* Have we not here a transition-term to that familiar household word?

Then, if so, our lake becomes at once historic in its appellation; it retains within its syllables an interesting memento of by-gone times. and it falls into the category of the other great lakes in respect to nomenclature. As the Upper Lake derived a name from the Ojibwas on its borders, and the next in descending order was designated from the Wyandots or Hurons, the next from the Illinois, and the next from the Erigés or Eriés, so the next was the lake of the distinguished tribe of the Entouhonorons or Senecas.

And if any etymological element seeming to signify "beautiful," has been discovered in "Ontario," by those who have had some acquaintance with the local aboriginal dialects, the coincidence has been most probably accidental—one of those chance literal or syllabic resemblances which are so frequently to be met with in the comparison of languages, and on which it is generally unsafe to build.

# ON THE POWER THAT CERTAIN WATER BIRDS POSSESS OF REMAINING PARTIALLY SUBMERGED IN DEEP WATER.

BY BEVERLEY R. MORRIS, M.D.

*Read before the Canadian Institute, February 22nd,* 1862.

In watching the habits of some of the more aquatic of the water birds, I have often been greatly struck by the remarkable power many of them possess of keeping the body submerged for some time after they have allowed the head and neck to appear, on coming to the surface after a dive caused by fear. As far as my own observations go, birds do not make use of this precautionary measure when entirely undisturbed and ignorant of being watched: on such occasions, I believe, they always come up at once completely, and without any but the necessary interval between the emergence of the head and the upper part of the body. After having noticed this curious and self-preservative power once, it was impossible that I should not speculate as to the mode in which the bird accomplished this singular but most useful manœuvre.

In watching sea birds, such as the Cormorant, the larger divers, and the Guillemot, I have often seen them, when emerging from a dive caused by fear, project the head and neck first out of the water, the body remaining completely out of sight; the bird then looks round to see if any danger is near; if it is not satisfied with the appearance of things, it is under water in an instant, and probably does not come up again till at a considerable distance. Should, however, all be secure, after a few seconds it allows the usual portion of the body to appear, and this is evidently dependent on the will of the bird. On other occasions, when not much alarmed, instead of again diving it will allow the body to be slightly emerged, and continue swimming for some time in this state of partial submergence—like a deeply laden ship. To show how completely the position of the bird in the water, as to submergence, entire or partial, is under its own control, I will give one or two short extracts from the "American Birds" of the talented Audubon. In speaking of the *Plotus anhinga*, or Snake bird, he says:—"The anhinga is in truth the very first of all fresh-water divers. With the quickness of thought it disappears beneath the surface, and that so as scarcely to leave a ripple on the spot; and when your anxious eyes seek around for the bird, you are astonished to find it many hundred yards distant, the head, perhaps, merely above the water for a moment; or you may chance to perceive the bill alone, gently cutting the water, and producing a line of wake, not observable beyond the distance of thirty yards from where you are standing. With habits like these it easily eludes all your efforts to obtain it." In speaking of the Purple Gallinule (*Gallinula Martinica*) he says:—"It runs with great speed, and dives with equal address—often moving off under water with nothing but the bill above." Again, he says of the Common Moorhen (*G. Chloropus*):—"At all other times, when raised, they suffer their legs to dangle, proceed slowly to a short distance and drop among the reeds; or if over water, they dive and hide, leaving nothing but the bill projecting above the surface." One more and I have done. The Clapper Rail (*Rallus crepitans*):—"It dives well, remains a considerable time under water, and in this manner dexterously eludes its pursuers. When hard pressed it often sinks just below the surface, keeping the bill above in order to breathe, and in this position, if not detected, remains for a considerable time; if perceived and approached, it instantly dives, and uses its wings to accelerate its progress, but rises as soon as it comes to a place of safety." These extracts all show a wonderful power of control over their specific gravity in birds, which are, except the first, only moderately aquatic in their habits and conformation, and which one would hardly expect to exhibit the highest developement of diving powers.

Before entering on the mode in which the bird accomplishes this state of submergence, it may be well to remark that birds, in addition to the air contained in their lungs, are also furnished with large cavities called air cells, in every part of the body, where they do not interfere with the organization of the part. These air cells communicate with the lungs, but do not appear to be capable of being emptied of the contained air at the will of the bird. The bones and barrels of the feathers are also full of air, so that the bird is naturally a good deal lighter than water, and cannot sink without some effort on its own part.

I will now proceed to consider the main subject of inquiry, namely, how the bird probably may be supposed to alter its buoyancy to such an extent as to enable it to maintain the whole of its body just beneath the surface of the water. It is manifest to any one who is at all conversant with the laws of hydrostatics, that in *deep water* this can only be accomplished in one of the following ways, by either of which the body of the bird might be supposed to be rendered of, as nearly as possible, the same specific gravity as the water in which it swims:—

1st. The bird might expel so much air from its body as to remove its power of floating on the surface of the water; or,

2nd. It might so compress its body as to condense the air in the various cavities to such an extent as to place it in the required condition.

With regard to the first of these suppositions, namely, that the bird might expel so much air as to remove its power of floating on the surface, although it is considered by some writers on the subject to be a plausible explanation of the phenomenon, I cannot think that it is the true one; for, in the first place, we have no evidence that the bird has any power, as to expulsion at least, over the air in the various air cells, which constitute the great bulk of the air vessels contained in its body. Indeed the general impression among anatomists is that it has no power at all over it; and, even if it had, I cannot think it would be possible for the bird to expel it so quickly as would be necessary to produce such an immediate effect as does actually take place; nor would the bird have the power of again taking it in so rapidly as it manifestly must do to enable it to float at its ordinary level in so short a time after partial submergence as it in reality does.

In a paper on this subject the Rev. J. C. Atkinson says:—"I will shoot a Moorhen in the act of diving, and will add to its specific gravity by depositing within its body some twenty or thirty grains of No. 5 shot. Of course then it will sink, and unless my retriever is a rather uncommon one I lose the bird. But no such thing; the Moorhen comes to the surface immediately, and floats almost as buoyantly as ever; and yet whence and how can the air have been procured, which has been applied to the replenishing of the air vessels and the restoration of the bird's buoyancy." I will endeavour, when considering the second supposition, to give what I believe to be the true explanation of this fact, for it is only as a fact that it is brought forward by Mr. Atkinson, as being opposed to the idea that the bird expelled the air from its body before submergence, and which was the hypothesis of his opponent, Mr. Slaney. I have very little doubt in my own mind that the muscular system of the bird would enable it so to compress its body as to expel sufficient air to make it of the same specific gravity as water, were the various air cavities so arranged as to allow of free egress and ingress. But, unfortunately for this theory, such is not the case, and I much doubt whether the removal of all the air in the numerous air cells, the bones and feathers, would be possible even under the air pump. Another argument, also, which bears strongly against this idea is, that were the bird to get rid of the air from the air cavities, it could only do so through the lungs, which thus must be in the same condition, and the bird would necessarily become suffocated for want of the quantity of air absolutely essential for respiration, and which the bird can do without worse than any other animal; for its circulation, and consequently its respiration, is very rapid, and it is this which enables it to keep up its natural heat under circumstances that would be fatal to animals otherwise constituted. No; every bird on diving has the power, if it sees reason to exercise it, of arresting its own progress upward, so that it shall at first only shew its head and neck, or only its bill, above water, and it can in this state take in a fresh supply of air, and this, too, in a single second, sufficient to enable it to take a long dive before again coming up, as every one must often have observed. How would it be possible for the bird to perform all this if it had gone down with such a reduced quantity of air as must have been the case had this been the mode of accomplishing its purpose.

I will now dismiss this hypothesis and proceed to consider the second mode.

2nd. It might so compress its body as to condense the air in the various cavities to such an extent as to place it in the required condition.

It is a well known fact that if you condense a cubic foot of air into a vessel already containing another cubic foot under the ordinary atmospheric pressure, you do not increase the buoyancy of the vessel in water by the additional quantity of air, but the contrary—you lessen it, and make it sustain less weight in the water by somewhere about 535 grains. Now, I cannot help thinking that here we have the true solution of the difficulty in question. No one, I imagine, will deny that if the bird has the power of compressing itself to a sufficient extent, it must sink instead of swim. Let us now see whether it would be possible for a bird to compress itself to such an extent as to be in the condition of the vessel with the two cubic feet of air. To establish this point, I will again quote from Audubon's "American Birds." In speaking of a young bird of the Least Bittern (*Ardea exilis*) which stood on the table while he made a drawing of it, he says, "Replacing it on the table, I took two books and laid them so as to leave before it a passage of an inch and a half, through which it walked with ease. Bringing the books nearer each other, so as to reduce the passage to one inch, I tried the Bittern again, and again it made its way between them without moving either. When dead, its body measured two inches and a quarter across, from which it is apparent that this species, as well as the Gallinules and Rails, is enabled to contract its breadth to an extraordinary degree."

Here it is clear that this bird was somewhat in the condition alluded to, and this, too, without much apparent inconvenience; and I feel convinced the amount of compression which evidently existed in this case would be abundantly sufficient to produce in a Water Bird the difference between floating well out of the water and being merely suspended in it. In another place, Mr. Audubon says of the Virginian Rail (*Rallus Virginianus*): "Like the two preceding species, (*R. elegans* and *crepitans*), the Virginian Rail has the power of contracting its body to enable it to pass with more ease between the stalks of strong grasses and other plants."

Now if these birds have the power of compressing themselves to so great an extent to enable them to move easily in their coverts, is it at all improbable that diving birds should have a similar power, and one that would be of such great value to them in enabling them to preserve themselves in times of danger. But further, when a man attempts to dive, he takes a full inspiration first, and then, when diving, he powerfully exerts all the large muscles round the body, I have little doubt to produce instinctively the same effect that I suppose is produced in the diving bird, namely, to bring the specific gravity of his body nearer to that of the water, and so make the diving easier. Again, Mr. Atkinson said that a Moorhen shot when diving instantly rose to the surface, notwithstanding the lead he had put into it. But why? Simply because, the bird being dead, the act of volition by which it compressed its body was gone, and the contained air instantly assumed its usual bulk, and the bird its usual position. So in the case of any bird diving from fear; it rises to the surface with its body in a state of compression; it at first only allows its head and neck to emerge, but, on looking round and seeing no danger, it suddenly relaxes the effort which it had till then kept up and its body instantly resuming its usual state, the bird as quickly assumes its natural position, and floats buoyantly on the water. Let, however, some slight occurrence disturb it, not enough to make it dive, and it instantly sinks itself deeper into the water, and remains submerged until it finds that all danger has disappeared. It runs no risk of being suffocated, for the condensed air is just as capable of sustaining life as ordinary air, and will do so just as long as a common inspiration. The bird, too, in this compressed state is able to inspire regularly, though of course in a constrained manner.

Let us now take one illustration from another class of Nature's works —I mean the Pearly Nautilus. The shell occupied by this curious animal is of considerable size, but has only a small portion of its cavity filled by the body of the animal. The rest of the shell is composed of cells, with the interior of each of which the animal has a direct communication by means of what is called the siphuncle or tube. These cells, in their natural state, are filled with air or gas of some kind; and it is clear that in this condition the animal must float on the surface of the water, and cannot while in that state sink. But there is a very curious provision to obviate this inconvenience, for as soon as the animal is frightened, or from any other cause contracts its body within the front part of the shell, water is by this very act forced down the tube, and so into all the cells, and thus compressing the air, the buoyancy of the animal is lessened, and it sinks in the water. When the animal wishes to rise it protrudes the head, and this opens the communication between the cells and the external water, and the air expanding forces out the water, and the animal again floats. Here we find an action analagous to that of the bird, produced without the slightest deviation from any of the known laws of Nature. It is true it is executed by a different application of the same principle which I have supposed to be called into action in the case of the bird, but manifestly only so modified on account of the peculiar formation of the animal; I mean from its external covering being rigid. Had it a power of contracting its outward covering, that is, its shell, to one-half its usual bulk, as I have proved the bird to have, it would no doubt exercise it, as the simplest way of producing the desired effect. The water it takes in is manifestly of no use as ballast, for water will not sink in water, and moreover the water at the surface is always warmer than that below, and consequently would rather tend to make it float. Its only use, therefore, must be to compress the air. If it was intended that the bird should use the same means to alter its specific gravity, would it not be provided with some special apparatus, as we see the Nautilus is? No such provision, however, nor the most distant approach to it, exists in the bird; but its external surface is capable of great compression, and is abundantly furnished with powerful muscles, the combined action of which would be to compress the body, and they are under the control of the will of the bird. With the knowledge of all these facts before me, I can come to no other conclusion than that the bird does so compress its body as to condense the air in its various cavities to such an extent as to render the specific gravity of its body about the same as that of the water in which it swims.

## REVIEWS.

*The Genetic Cycle in Organic Nature*; *or*, *the Succession of Forms in the Propagation of Plants and Animals.* By George Ogilvie, M.D., Regius Professor of the Institutes of Medicine in the University of Aberdeen; author of "The Master Builder's Plan in the Typical Forms of Animals." Aberdeen: A. Brown & Co. Edinburgh: John Menzies. London: Longman & Co. 1861. Crown 8vo, pp. 296.

In a former volume of this Journal we gave some account of the author's previous work, "The Master Builder's Plan," which is a very pleasing one, fitted for popular use, and perhaps better fitted than any we are acquainted with to give a good general idea of the plan of creation in the animal kingdom. The present volume has been long upon our table, but has always seemed to us to demand more attention than we could at the moment bestow upon it; and though it has interested us much, we must now be content with a slight notice, that we may no longer omit to recommend it to physiological inquirers. If decidedly less fitted for popularity than the former work, it has certainly no less claims on the attention of the real student of Nature, and in proportion to the difficulty and obscurity of the questions involved ought to be the interest excited in attempts at their solution. It may safely be said that candid inquirers will find in Dr. Ogilvie an useful guide, and whatever may be thought of some of his theoretical views, the information brought together is such as could only be collected by the study of many volumes relating to different departments, and some of them difficult of access, whilst the systematic manner in which it is presented greatly enhances its value. In order to give some idea of the work before us we shall first lay before our readers the character and order of the subjects treated, in a list of the titles of the several chapters. We may then select a few particulars for more special notice, without, however, attempting to examine in detail the peculiar views proposed, or to give any opinion respecting them, beyond our conviction that the book deserves the attention of all who pursue physiological studies. The divisions of the subject are as follows:—I. Derivation of Organic Beings. II. Survey of the Reproductive Process in the Vegetable Kingdom. III. Do. in the Animal Kingdom. IV. Nature and Varieties of Alternation of Generations. V. Pullulation. VI. Embryogeny, as representing one Form of Alternation. VII. Representation of the other Forms. VIII. Relations of Ova and Gemmæ. IX. Summary of Conclusions. X. Cases Simulating Alternation of Generations. XI. Homological Relations of the Structures concerned in the Genetic Cycle. There is an appendix of tables exhibiting the order and supposed relations of phenomena in different divisions of organized beings, and there are six illustrative plates, which, though of no great merit in their execution, sufficiently convey the ideas intended, and will be found an assistance by such readers especially as are little familiar with the subjects. The author commences by laying down as the best distinction between organized and inorganic substances the derivation of the former "by a process more or less direct from previously existing individuals of a like kind." In the case of organic bodies, which is thus contrasted with the nearest approaching results of mechanical or chemical agencies, "not only must their ultimate chemical elements be present in some shape or other, but they must be present as combined by the prior operation of the living powers of individuals of a like kind into fertilized germs or other reproductive bodies. If such a germ or reproductive body has been normally constituted, then, and then only, will the application of certain appropriate influences of light heat, chemical action, &c.,

become the means of its being developed into a body eventually resembling that from which it was itself derived."

This is cautiously expressed so as to include all the varieties ever supposed of parental derivation, whilst entirely excluding what has been called equivocal generation ; and the paragraph is immediately followed by a candid statement of difficulties raised on that subject, tending to justify the opinion generally prevalent among physiologists unfavourable to the possibility of the origination of organic beings *de novo*. A large portion of the volume is occupied by a survey of the reproductive system, first in the vegetable then in the animal kingdom. This portion of the work is very valuable to a student, and appears to be a careful summary of ascertained facts, although in some instances already, in the short interval since this account was prepared, the field of knowledge has been enlarged. Since the publication of the volumes of Agassiz on the Acalephæ, we can hardly accept as satisfactory the account here given of the Hydrozoa, and other points are more or less questionable, yet we could refer to no better abstract of information on the subject, especially in so accessible a form.

The chapter on "the Nature and Varieties of Alternation of Generations," is both remarkably interesting in itself and important in its bearing on the author's theoretic views. We make a somewhat extended extract in order to bring the latter before our readers—whilst for the facts we refer them to his own pages.

> § 1. The two modes of propagation—by gemmæ capable of spontaneous evolution, and by germs dependent on impregnation—as has been already observed, are frequently associated with no less remarkable diversities in the immediate result of the development, leading in cases of periodic recurrence or alternation of the former, to a corresponding mutation or alternation of dissimilar forms in the same species. It is only, however, quite recently that this has been admitted generally by zoologists, who were not unnaturally indisposed to it, by observing the constant succession of like to like in the higher animals. But since the time that Chamisso called the attention of naturalists to the recurrence of two forms in *Salpa*, as a case of "Alternation of Generations," analogous phenomena have been abundantly brought forward in other tribes of organized beings. Steenstrup was the first to group together these cases, applying to them the same term as was used by the former naturalist, for which some later writers would substitute that of *Metagenesis*, proposed originally by Professor Owen.
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> In all these cases we may admit so much as this in common—that an act of digenesis recurs with greater regularity in the interval of the acts of monogenesis ;

and that the products of the former differ more or less in their conformation from the organisms budded off in the latter.

Hence, as both forms must be taken into account to complete our idea of the perfection of the species, it has been proposed to term them zooids in the case of animals, and phytoids in that of plants, as indicating that any one of them is not so much a complete animal or plant in itself, as a fragment or fractional part of one—the whole series, considered as a specific unit, rather than any one among the successive links of which it is made up, answering to our idea of individual completeness, as this is drawn from the higher animals, in which like seems always to produce like.

In confirmation of such a view, it is noticed that in not a few cases these fractional phytoids and zooids really remain in organic union for life—making up an arborescent form—like what we call a polypidom in animals, which is readily recognized as being in its entireness the individual representative of the species.

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Though we may allow so much in common in these cases of "alternation," as is involved in the occurrence in all of a periodic diversity of derived forms, there are yet—as was pointed out in the introductory chapter—great variations among them, as far as the relations are concerned in which the budding process stands to the sexual act, and to the full development of the specific type—relations depending on the period of the life-history of the species, at which the act of gemmation is interpolated in the genetic cycle. The contrast lies especially between the cases in which the alternation of form is due to zooids being budded off in the *Protomorphic* stage of the life-history—that is, during the early progress of germinal development—and those in which it arises from the detachment of gemmæ in the fully developed or typical phase, as a preliminary step so the evolution of reproductive organs—the latter zooids belonging to the *Gamomorphic* stage, or that of sexual maturation. The two classes—as has been already observed—differ widely in their structure and relations. In the one case they are the primary products of impregnation, precursors of the perfect form, and without sexual characters—in the other derivative, and with distinct sex. Zooids of both kinds, indeed, may have certain organs superadded, varying in their nature and completeness with the circumstances of their life as independent beings. In those of the protomorphic stage, the adventitious organization probably does not go beyond the development, externally, of cilia, or of a contractile integument for locomotion, and internally, of a rudimentary digestive apparatus; but in many gamomorphic zooids, both the locomotive and alimentary systems may be rather highly organized, and the whole structure occasionally larger and more complex and elaborate than that of the parent stock. On the other hand, such is the structural degradation of some zooids of both kinds, that they might readily pass for mere proliferous cysts or egg-sacs. This variability in the kind and extent of organization proves of itself its adventitious nature, and shows it to be of no value as a distinctive feature. The real points of distinction are those before referred to—their position in the genetic cycle, and their gemmiparous or sexual character in consequence. They both, however, have this in common, that the great end of their existence is the multiplication of the race—an end to which the nutritive and animal functions are always subordinated.

We now pass to the fourth chapter, whence we must quote a passage explanatory of the most recent speculation on the origin of "double monsters."

A single ovum has been observed to originate two distinct axes of embryonic growth. Cases of a double primitive trace of organization have been met with in the bird's egg, by Dr. Allen Thomson and others, and it is probably in some such way that we may most feasibly account for the origin of what are termed "double monsters."* At all events we have in these, as much as in the best marked cases of alternation of generations, a production of two more or less typical organisms from a single original germ; for it is now generally agreed that such monstrosities cannot be well explained on any supposition of the fusion of two independent embryos.

This conclusion rests principally on the following considerations :—

1. In all such monsters the duplicated parts are connected together, and derive their vessels from a common trunk; we never find a face springing out of the chest, legs implanted on the head, or any such mal-position of parts.

2. Double monsters form a continuous series, in which the degrees and modes of deviation from singleness gradually increase, and pass, without any abrupt steps, from the addition of a single ill-developed limb to the nearly complete formation of two perfect beings; so that no theory can be tenable that will not account for the simpler as well as the more complete instances of duplicity—that cannot explain, for example, the existence of superfluous limbs. As M. Vrolik remarks, "the limbs are mere off-shoots, and are produced at so late a period, that if we could imagine two embryos to come in contact by their shoulders or pelvis, and a fusion of those parts to take place, we should still have to explain how one of them, leaving only an arm or a leg behind him, could for the rest of his substance, head, trunk, and all, wholly disappear."

3. The two monsters are always of the same sex, which we know, from the case of twins, is very far from being a constant rule with associated embryos.

The theory of the furcation of a germ or embryo, originally single, is farther supported by an observation of Valentin's, that an injury inflicted on the caudal extremity of an embryo on the second day was found on the fifth to have produced the rudiments of a double pelvis and four inferior extremities.†

Reference may be made also to the observations on the development of the ova of fishes by M. Lereboullet, according to whom, in particular species—as the Pike—the formation of such monstrosities may be determined at pleasure, by placing the eggs in certain conditions unfavourable to development. In this case the blastodermic ridge forms on its surface two tubercles instead of one, and from each of these an embryonic fillet is produced, the farther development of which gives rise to double embryos of various kinds.*

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* Edinburgh Monthly Journ. Med. Science (1844), IV., pp. 479, 568, 639. See also Vrolik's article on Teratology. in Cyc. Anat. and Phys.

† Vrolik, Op. Cit.

It will be observed that the explanation here given of dublication involves a principle like that called *chorisis* in plants, which is employed, with more or less plausibility in different instances, to account for increase in the number of floral organs. We have seen reason to reject its application in several instances where it has been alleged by eminent botanists; but we have never gone so far as to deny that there may be instances in which it supplies the best explanation of remarkable phenomena, and the probability would be increased by a good analogy with what occurs in the animal kingdom.

What follows occurring in connection with the notice of detached sexual structures may suggest a new idea to some, and the appended note details a curious fact only lately established:—

> In fact, the whole question of detachment hinges on the proportionate development of the *somatic* life, *i. e.*, the life of the body as one whole, and the more or less independent life of its several organs, or what we may term the *topical* or regional life. In the higher animals the special actions of the several organs are as completely subordinated to that of the body as a whole, as are the powers of local corporations to the central government in any well-ordered state, yet there still remains sufficient evidence of the real existence of a *distinct* topical life. The hairs and teeth of animals generally, and the antlers of the deer, have already been cited as furnishing illustrations of it. The first set of teeth, for instance, are formed each in its own capsule by a process of local growth, quite independent of that of the neighbouring tissues, nay, in so far opposed to it, that at a certain stage of development the integuments of the gum are partially disintegrated to allow of their eruption. A tooth, thus generated by independent growth, some time after attaining maturity, undergoes a process of decay, ending in its ultimate removal, when a new tooth of the second dentition takes its place by a similar process of local growth. In its turn this tooth also is shed, and though in most species it has no successor, yet in a few there is a constant succession during the whole lifetime of the animal; and this is the general rule in the case of the hair.† Hence in such local formations as teeth, hair, &c., we have, in the way they are marked off from the neighbouring parts, and in this succession of growth, maturation, and decay—repeated again and again, and epitomizing, as it were, the life of the animal on which they grow—evidence of a vitality, quite as defined perhaps in itself as that presented by the free zooids of the lower species, though their functional dependence on the common circulation, and the mechanical bond of a common integument, prevent their exhibiting the more obvious phenomena of a separate life. But as we descend in the scale of

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* Annals of Nat. History, 2nd Ser., XVI., 49.

† Paget's Lectures on Surgical Pathology. Kirkes' Handbook of Physiology, Ch. X.

organization we come to species, where, from the absence of centralizing influences, the several organs—which are possessed of a vitality, less energetic perhaps, but more enduring than in the higher—become emancipated, as it were, from the control of the general system, and appear as zooids, that is, in the guise of independent beings, rather than as integral parts of the same animal—suggesting a comparison to a loose confederation of Indian tribes, or to the feudal system of the middle ages, rather than to a well-ordered polity of our own day.

And though the proper organs of reproduction, from their partial independence even in the higher animals, seem, as we might expect, to manifest most clearly this emancipation from the controlling influence of somatic life, yet it is seen very distinctly in others also, as, for instance, in the peculiarly modified tentacle of the *Argonauta*, which, when fill'ed with spermatic fluid, is detached from the body, and finds its way spontaneously to the female for the purpose of impregnation.*

We must now bring this notice of a valuable addition to physiological literature to a conclusion, which we do with an expression of our expectation that it will be appreciated and widely circulated among the curious in biological science. W. H.

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*A Treatise on some of the Insects injurious to Vegetation.* By Thaddeus William Harris, M.D. A new edition, enlarged and improved, with additions from the Author's MSS. and original notes. Illustrated by engravings drawn from Nature, under the supervision of Professor Agassiz. Edited by Charles L. Flint, Secretary of the Massachusetts State Board of Agriculture. Boston: Crosby & Nichols; New York: Oliver S. Felt. 1862.

It would be superfluous to praise a work of such established reputation as the late Dr. Harris's report, written for the State of Massachusetts, on Insects injurious to Vegetation; but as it has been for some time out of print, and has been inquired for in vain by many, it may not be useless to inform our readers that it now appears in an improved edition, with every advantage that the best paper and printing, and an admirably executed series of illustrative wood cuts and coloured plates can bestow. No one need desire a more pleasing book for his library than Dr. Harris's work in its present form ; and all who are interested in horticulture and rural affairs, as well as in Entomology, will find it eminently useful. We recommend it most cordially. W. H.

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* The worm-like appearance led at first to its being described as a parasite of this organ under the term of *Hectocotylus*; and even after its sexual relations were determined by Kölliker, it was still considered as an integral, though rudimentary animal, and in this point of view was employed by Darwin (in the first volume of his monograph of the Cirrhipedes) in illustration of the nature and relations of the minute parasitic males occurring in certain genera of that group. The discovery of its true nature as a mere tentacle of a Cuttlefish is due to Verany and H. Müller.

# SCIENTIFIC AND LITERARY NOTES.

## ZOOLOGY.

### THE SNOWY OWL.

The local papers contain several notices, two of which we subjoin, of the occurrence, in great numbers of *Nyctea nivea* (*Strix nyctea*, Linn.), the Snowy Owl, on the shores of Lake Ontario. Amongst others, the well-known taxidermist, Mr. Passmore, speaks of having from 30 to 40 specimens in his possession, shot in the neighbourhood of Toronto during the past three weeks. We hear, through private sources, of an equal abundance of this fine bird about Hamilton. At this season, when they migrate from the north, specimens may generally be procured ; but the extraordinary numbers this year excite great attention, and arouse our curiosity respecting the cause. Is it to be sought in circumstances in the northern regions having favoured the bringing-up of a much larger number than usnal, in greater severity of cold driving them more rapidly and in a more crowded manner on their southern wanderings, or in a peculiar abundance of suitable food around our lake, bringing together in this quarter all the emigrants from a wide-spread region?

We are informed that they appeared in similar numbers in 1837; and Mr. Passmore gives 1833, 1839, and 1853 as abundant years. Mr. Passmore speaks of the male as almost invariably white; the female larger, and beautifully mottled with black. The greater size of the female is observable in many birds, and is very characteristic of *Raptores*. The young male is marked like the female, and continues to be so for some time, gradually losing the spots, until at a good age he reaches a snowy whiteness. Hence as comparatively few escape the various dangers to which they are exposed, very white specimens are always much valued by collectors. It is interesting to observe the progress made from year to year in assuming the white livery; but a majority of the males obtained have the spots almost as conspicuous as the females. W. H.

*To the Editor of the Leader.*

SIR,—In your paper of the 12th inst., I noticed an account of the capture, by a Mr. Harvey, of a large owl, which, by the description given, appears to have been the snowy owl (*Strix nyctea.*) According to Wilson, these birds have their home among the barren rocks of Greenland, and are only driven to our more temperate region by the severity of winter. In their migratory course, they seem to keep by the line of the great lakes, attracted, doubtless, by the quantities of dead fish and waterfowl which at this season of the year are strewn along the shore. In this vicinity a few are generally seen every season; but never, in the recollection of the oldest inhabitant, have they appeared in such numbers as during the present month.

On the 12th inst., the writer, in company with a friend who is making a collection of Canadian birds, visited Burlington Beach, in the hope of obtaining a specimen of the Snowy Owl; and getting there shortly before sunrise, were surprised to find these noble birds quite numerous, and flitting about like ghosts in the grey light of the morning They were rather difficult of approach, usually alighting on a post or dead limb of a tree, from which they kept a vigilant watch for intruders; but by ten o'clock, seven specimens were obtained, all in fine plumage. The female exceeds the male in size, and has the dusky spots larger and more numerous. I am, &c.,

Hamilton, November 17th, 1862. Strix.

*To the Editor of the Leader.*

Sir,—In your paper of the 13th inst., you refer to the fact of a large owl having been shot by a Mr. Harvey, and state that it is the only bird of the kind ever seen by him in its wild state. This would lead one to imagine that this variety—the Snowy Owl (*Strix nyctea*)—was rare. This is not the case. I have now in my possession between forty and fifty specimens, which have been shot in this neighbourhood during the past two or three weeks, some of these measuring five feet four inches from wing to wing.

The male of this species is almost invariably white. The female is larger, and is beautifully mottled with black. During the past two years they have been rarely shot in this vicinity, but they were in great plenty in 1833, 1839, and in 1853. Yours, &c.,

Toronto, November 17th, 1862. S. Passmore.

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### POISONOUS PARTRIDGES.

In the 'Times' of Wednesday, September 10th, is a letter from Mr. F. Taylor, of Romsey, giving an account of some cases of poisoning by the flesh of Canadian partridges. It appears that in Canada, when the snow is on the ground, the birds are forced by hunger to feed on certain berries which render them unsafe for human food. What these berries are does not appear. Mr. Taylor's account of the poisonous effects produced is as follows:—

"On the 8th of last March I was sent for hurriedly to a lady who wrs described as dying. I found her cold, insensible, and pulseless. She had been sick while lying upon her back. I forced her to swallow a wineglassful of brandy, and took other measures for some hours to stimulate and recover the warmth and circulation, and partially succeeded. She remained, however, insensible, and almost in a hopeless state for many hours, at last gradually recovering, but for several weeks suffered from ill health in many ways. On regaining her consciousness, and during the whole of the following day, she experienced a most uncomfortable sensation of 'acute thrilling,' especially on the slightest movement of the muscles of the face. I suspected poison in this case, but I could not recognise the symptoms of any one poison in particular. I found that the lady had dined about two hours and a half previously to the attack, and that she had eaten part of one of these Canadian partridges. The birds were perfectly fresh, having been packed in ice. Five days after this occurrence I was sent for hurriedly to see a younger lady, the wife of a gentleman who had had a case of partridges sent him from Canada, and who had presented a brace of them to my first patient. I found this lady cold and pulseless, and feeling paralyzed, with 'a peculiarly horrid thrilling sensation all over her,' and a very painful sense of constriction in her throat. She had eaten for supper heartily of one of these Canadian partridges, and within a few minutes felt ill as I have described. I gave her mustard emetics, and afterwards brandy in large quantities; and gradually, after many hours of intense suffering, the lady recovered, and in a few days regained her usual good health. On the night of her extreme illness, while sitting in the bedroom, I noticed a young cat there, which, in attempting to move, fell over on its side, and upon lifting it up I found the hinder legs paralysed, so as to be quite useless; and upon the poor thing attempting to walk or leap, it fell helplessly on its side again. The lady told me that during supper she had thrown to this cat some bits of the patridge. It was found that the poor thing had been thoroughly sick. The cat continued to be paralysed, but gradually recovered in a few days, no doubt saved by the natural act of vomiting. My impression is, that the younger lady might have recovered without help; but she was, I am certain, very materially benefitted by induced sickness and by large doses of brandy. The elder lady, I feel sure, would have died unless prompt and continued strong measures had been taken to keep the flickering and almost exhausted flame of life burning."

It has long been known that the poisonous principles of certain plants retain their properties after having passed through the digestive laboratory and become incorporated in the tissues or secretions Modern chemistry, by showing that the vegetable alkaloids pass through the animal body undecomposed, and may be detected under favourable circumstances, has only confirmed a very common observation. The flesh of hares which have browsed on the *Rhododendron chrysanthemum*, and that of young pheasants after feeding on the buds and shoots of the *Kalmia latifolia*, acquire deleterious properties. So also the milk and flesh of cattle grazing on some of the mountain herbage of South America have been found poisonous. Some time ago several persons near Toulouse were poisoned by a dish of snails, which had been fattened on the leaves and shoots of *Coriaria myrtifolia*. In all these instances the vegetable principles seem to be incapable of affecting the animals themselves. The poisonous effects of honey obtained by bees from certain species of Kalmia, Azalea, and Rhododendron, are also well known. It is said that the plague mentioned by Xenophon, from which the 10,000 Greeks suffered in their retreat, was produced by eating honey collected from the *Azalea Pontica*—the " Œgolethron " of the ancients. The effects produced by such honey are of a narcotico-irritant character, and in some instances have been of long duration. Even the mead made from it is highly poisonous.—*Med. Times and Gazette.*

## MISCELLANEOUS.

### MEETING OF ENTOMOLOGISTS.

A highly interesting meeting of Entomologists was held on Friday evening, September 26th, at the residence of Professor Croft, Yorkville, for the purpose of taking into consideration the advisability of forming a club or society of those engaged in the study of Insects.

The following gentlemen were present:—The Rev. Prof. Hincks and Prof. Wilson, of University College, Toronto; Dr. Cowdry, York Mills; Dr. B. R. Morris, Toronto; Thos. J. Cottle, Esq., Woodstock; W. L. Lawrason, Esq., E. Baynes Reed, Esq., and Wm. Saunders, Esq., of London, C. W.; and the Rev. C. J. S. Bethune, Cobourg.

A large number of specimens were exhibited by many of those present, among which may be especially mentioned the varied and extensive collection of Prof. Croft. After these had been duly inspected, the attention of the meeting was directed to the object for which it had been more particularly assembled, viz., the formation of an Entomological Club. A discussion therefore arose, in the course of which, while all concurred in the opinion that such a club would be very beneficial in many respects, it was agreed upon that, for the present, no organization should be attempted, inasmuch as so few Entomologists were present; but that efforts should be made to hold another meeting next spring, about the time of the Annual Conversazione of the Canadian Institute.

The advantages to be derived from such a club as that contemplated, are undoubtedly manifold and great. In the first place, the results of the investigations of Entomologists in various parts of the country would be made available for mental information and assistance, and not confined, as hitherto, to a single individual and his particular correspondents. In the next place, a complete list of the various genera and species of Insects known to inhabit the country, could in a short time be formed from the collected materials of isolated students, and by this means reliable data be afforded on which to base further operations. Again, encouragement would be given to those now almost disheartened by the difficulties of the pursuit. New votaries would soon be attracted; and, in short, Entomology would receive such an impetus as would raise it to the level of other more favoured branches of science.

That such beneficial results may be obtained, however, it is necessary that there should be perfect unanimity with regard to the manner in which the machinery is to be set in motion, and that all should co-operate willingly and heartily in the undertaking. Looking at the smallness of the number of those at present engaged in the study of Insects in this country, such results may appear to many as but the fond aspirations of an enthusiast; but when we contemplate what has been done elsewhere, and consider from what feeble beginnings some of the mighty societies in the Mother Country and abroad, derived their origin, such anticipations are surely by no means visionary or absurd. Let Entomologists only endeavour,—each one in his own locality,—to do all that lies in his power for the furtherance of these designs, and they may feel assured that success, beyond perhaps what they now imagine, will undoubtedly crown their efforts.

B.

### SCIENTIFIC BALLOON ASCENT.

Several balloon ascents have recently been made for scientific purposes by Mr. Glaisher, accompanied by, and under the guidance of, the celebrated aëronaut Mr. Coxwell. The most remarkable and one of the most eventful of these took place on Friday, the 5th of September. The day was capricious, being alternately fine and lowering, until finally, at the time of starting, an afternoon's rain seemed inevitable. The cords were loosed exactly at one o'clock, and the balloon coasted off in a southwesterly direction. The balloon, as on previous occasion, was not quite filled, on account of the expanding effects of the atmosphere at two or three miles' altitude. It contained 60,000 feet of excellent gas, prepared under the able superintendence of Mr. Proud, engineer to the gas-works. Some pigeons were on this occasion allowed to accompany the expedition. In addition to the instruments previously taken, Mr. Glaisher took with him a camera, in order, if possible, to take photographs of the different phases of the clouds. He also took a newly-invented barometer, for the purpose of securing more correct observations of the state of the atmosphere than were previously possible. These observations have formally been taken by Gay-Lussac's siphon barometer and an aneroid; but as the correctness of the readings of the siphon barometer mainly depend upon having a perfectly calibred tube, and as the large size of the general barometer tube renders perfect calibration impossible, or at least very difficult, Messrs. Negretti and Zambra have constructed a barometer expressly for the purpose of checking the observations which have been made in order to test their correctness. With this view a good tube was selected, six feet in length, and the mercury boiled through the whole of that length. A cistern was then blown on its lower extremity, and a stopcock added, by which means the mercury was allowed to decrease inch by inch from the tube into the cistern, and the rise which took place in the cistern was subsequently accounted for in dividing the scale; the upper part of the tube was used to construct the barometer; and by this instrument a direct reading is obtained without any corrections being necessary for the displacement of the mercury in the cistern down to eight inches. The difference, if any be found, between this barometer and the Gay-Lussac siphon used in former ascents will be due to the inequalities in the tube of the latter. Among others, Lord Wrottesley was present when the ascent took place. The following interesting account of this ascent was furnished by Mr. Glaisher to the 'Times':—

*To the Editor of the 'Times.'*

Sir,—On the earth at 1h. 3m. the temperature of the air was 59°; at 1h. 13m., at the height of a mile, it was 39°; and shortly afterwards we entered a cloud, which was about 1100 feet in thickness, in which the temperature of the air fell to 36½°, and the wet-bulb thermometer read the same, showing the air here was saturated with moisture. On emerging from the cloud at 1h. 17m. we came into a flood of light, with a beautiful blue sky without a cloud above us, and a magificent sea of cloud below; its surface being varied with endless hills, hillocks mountain chains, and many snow-white masses rising from it. I here tried to take a view with the camera, but we were rising too rapidly and revolving too rapidly for me to do so; the flood of light, however, was so great that all I should have needed would have been a momentary exposnre, as Dr. Hill Norris had kindly furnished me with extremely sensitive dry plates for the purpose.

When we attained the height of two miles, at 1h. 21m., the temperature had fallen to the freezing-point; we were three miles high at 1h. 28m., with a temperature of 18° ; at 39m. we had reached four miles, and the temperature was 8° ; in 10 minutes more we had reached the fifth mile, and the temperature of the air had passed below zero, and there read minus 2° ; and at this point no dew was observed on Regnault's hygrometer when cooled down to minus 30°. Up to this time I had taken the observations with comfort. I had experienced no difficulty in breathing, while Mr. Coxwell, in consequence of the necessary exertion he had to make, had breathed with difficulty for some time. At 1h. 51m. the barometer read 11·05 inches, but which requires a subtractive correction of 0·25 inch, as found by comparison with Lord Wrottesley's standard barometer just before starting, both by his Lordship and myself, which would reduce it to 10·8 inches, or at a height of about 5¼ miles. I read the dry bulb as minus five degrees; in endeavouring to read the wet bulb I could not see the column of mercury. I rubbed my eyes, then took a lens, and also failed. I then tried to read the other instruments, and found I could not do so, nor could I see the hands of the watch. I asked Mr. Coxwell to help me, and he said he must go into the ring, and he would when he came down. I endeavoured to reach some brandy which was lying on the table at about the distance of a foot from my hand, and found myself unable to do so. My sight became more dim; I looked at the barometer and saw it between 10 and 11 inches, and tried to record it, but I was unable to write. I then saw it at 10 inches, still decreasing fast, and just noted it in my book; its true reading therefore was at this time about 9¾ inches, implying a height of about 5¾ miles, as a change of an inch in the reading of the barometer at this elevation takes place on a change of height of about 2500 feet; I felt I was losing all power, and endeavoured to rouse myself by struggling and shaking. I attempted to speak, and found I had lost the power. I attempted to look at the barometer; my head fell on one side. I struggled and got it right, and it fell on the other, and finally fell backwards. My arm, which had been resting on the table, fell down by my side. I saw Mr. Coxwell dimly in the ring. It became more misty, and finally dark, and I sunk unconsciously as in sleep; this must have been about 1h. 54m.

I then heard Mr. Coxwell say, "What is the temperature? Take an observation; now try." But I could neither see, move, nor speak. I then heard him speak more emphatically, "Take an observation; now do try." I shortly afterwards opened my eyes, saw the instruments and Mr. Coxwell very dimly, and soon saw clearly and said to Mr. Coxwell, "I have been insensible;" and he replied, "You have, and I nearly." I recovered quickly, and Mr. Coxwell said, "I have lost the use of my hands; give me some brandy to bathe them." His hands were nearly black. I saw the temperature was still below zero, and the barometer reading 11 inches, but increasing quickly. I resumed my observations at 2h. 7m., recording the barometer reading 11·53 inches, and the temperature minus 2. I then found that the water in the vessel supplying the wet bulb thermometer, which I had by frequent disturbances kept from freezing, was one solid mass of ice. Mr. Coxwell then told me that while in the ring he felt it piercingly cold, that hoar frost was all round the neck of the balloon, and on attempting to leave the ring he found his hands frozen, and he got down how he could; that he found me motionless, with a quiet and placid expression on the countenance. He spoke to me without eliciting a reply, and found I was insensible. He then said he felt insensibility was coming over himself, that he became anxious to open the valve, that his hands failed him, and that he seized the line between his teeth and pulled the valve open until the balloon took a turn downwards. This act is quite characteristic of Mr. Coxwell. I have never yet seen him without a ready means of meeting every difficulty as it has arisen, with a cool self-posession that has always left my mind perfectly easy and given to me every confidedce in his judgment in the management of so large a balloon.

On asking Mr. Coxwell whether he had noticed the temperature, he said he could not, as the faces of the instruments were all towards me; but that he had noticed that the centre of the aneroid barometer, its blue hand, and a rope attached to the car, were in the same straight line. If so, the reading must have been between 7 and 8 inches. A height of six miles and a half corresponds to 8 inches. A delicate self-registering *minimum* thermometer read minus 12°, but unfortunately I did not read it till I was out of the car, and I cannot say that its index was not disturbed.

On descending, when the temperature rose to 17°, it was remarked as warm, and at 24° it was noted as very warm.

The temperature then gradually increased to 57½° on reaching the earth. It was remarked that the sand was quite warm to the hand, and steam issued from it when it was discharged. Six pigeons were taken up. One was thrown out at the height of three miles; it extended its wings and dropped as a piece of paper. A second, at four miles, flew vigorously round and round, apparently taking a great dip each time. A third was thrown out between four and five miles, and it fell downwards. A fourth was thrown out at four miles when we were descending; it flew in a circle and shortly after alighted on the top of the balloon. The two remaining pigeons were brought down to the ground; one was found to be dead, and the other (a carrier) had attached to its neck a note. It would not however leave, and when jerked off the finger returned to the hand. After a quarter of an hour it began to peck a piece of ribond encircling its neck, and I then jerked it off my finger, and it flew round two or three times with vigour, and finally towards Wolverhampton. Not one, however, had returned there when I left on the afternoon of the 6th.

Too much praise cannot be given to Mr. Proud, the engineer of the gas-works, for the producfion of gas of such a light specific gravity.

It would seem from this ascent that five miles from the earth is very nearly the limit of human existence. It is possible, as the effect of each high ascent upon myself has been different, that on another occasion I might be able to go higher, and it is possible that some persons may be able to exist with less air and bear a greater degree of cold; but still I think that prudence would say to all, whenever the barometer reading falls as low as 11 inches, open the valve at once: the increased information to be obtained is not commensurate with the increased risk.

*Sept.* 9. JAMES GLAISHER.

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—AUGUST, 1862.

*Latitude*—43 *deg.* 39.4 *min. North. Longitude*—5 *h.* 17 *m.* 33 *s. West. Elevation above Lake Ontario,* 108 *feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resul't. Direction. | Velocity of Wind. | | | | | Rain in inches. | Snow in inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | Mean. | 6 A.M | 2 P.M | 10PM | ME'N | | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A.M | 2 P.M. | 10 P.M. | M'N | 6 A. M. | 2 P. M. | 10 P. M. | | 6 A.M. | 2 P.M. | 10 P.M. | Re-sul't. | ME'N | | |
| 1 | 29.690 | 29.644 | 29.624 | 29.6513 | ° 63.4 | ° 80.0 | ° 71.3 | ° 72.72 | ° + 5.75 | .494 | .629 | .509 | .567 | .85 | .61 | .66 | .71 | N W b W | S b W | N b W | ° S 63 W | 3.5 | 9.0 | 5.0 | 3.11 | 6.14 | ... | ... |
| 2 | .666 | .641 | .623 | .6415 | 68.1 | 76.0 | 71.3 | 71.82 | + 4.97 | .524 | .573 | .579 | .565 | .77 | .64 | .76 | .73 | N b E | S b E | E S E | N 69 E | 6.5 | 6.0 | 11.0 | 2.69 | 3.71 | 0.006 | ... |
| 3 | .623 | .565 | — | — | 66.6 | 76.7 | — | — | — | .572 | .551 | — | — | .87 | .59 | — | — | N E | E | E | S 73 E | 3.4 | 7.8 | 3.5 | 4.30 | 5.33 | ... | ... |
| 4 | .544 | .540 | .552 | .5338 | 73.8 | 82.9 | 73.5 | 77.22 | +10.42 | .663 | .822 | .716 | .737 | .80 | .73 | .87 | .79 | S S E | S b W | S b E | S 24 W | 5.4 | 10.2 | 3.8 | 8.60 | 8.93 | ... | ... |
| 5 | .524 | .569 | .649 | .5880 | 71.0 | 76.7 | 62.3 | 70.17 | + 3.37 | .671 | .628 | .471 | .583 | .89 | .68 | .84 | .79 | W S W | W b N | W N W | N 64 W | 5.5 | 9.0 | 5.0 | 6.57 | 7.60 | Inp. | ... |
| 6 | .748 | .775 | .802 | .7722 | 59.8 | 74.2 | 63.7 | 66.80 | + 0.03 | .405 | .511 | .452 | .460 | .78 | .60 | .76 | .70 | N W | S b W | W b N | S 70 W | 6.0 | 9.3 | 1.8 | 1.27 | 5.03 | 0.045 | ... |
| 7 | .803 | .694 | .556 | .6733 | 65.9 | 71.7 | 71.7 | 69.65 | + 2.97 | .595 | .560 | .603 | .588 | .93 | .72 | .78 | .81 | E b N | E b S | S W | S 39 E | 2.8 | 8.4 | 3.0 | 2.15 | 4.64 | 0.312 | ... |
| 8 | .506 | .454 | .382 | .4407 | 73.5 | 87.6 | 75.6 | 79.08 | +12.42 | .748 | .812 | .721 | .772 | .91 | .62 | .81 | .79 | S W | W S W | S W b S | S 54 W | 5.0 | 7.8 | 4.6 | 6.55 | 7.20 | Inp. | ... |
| 9 | .326 | .332 | .456 | .3777 | 74.2 | 83.6 | 64.5 | 73.73 | + 7.18 | .704 | .726 | .494 | .639 | .83 | .63 | .81 | .76 | W S W | W | N W b W | N 70 W | 2.5 | 18.5 | 3.0 | 9.28 | 10.05 | 0.038 | ... |
| 10 | .567 | .613 | — | — | 61.6 | 74.6 | — | — | — | .493 | .521 | — | — | .90 | .60 | — | — | N W | S b E | N N W | N 75 E | 2.8 | 4.5 | 3.0 | 3.60 | 4.46 | ... | ... |
| 11 | .575 | .484 | .427 | .4862 | 62.7 | 69.9 | 74.2 | 71.33 | + 4.90 | .404 | .670 | .677 | .610 | .71 | .92 | .80 | .79 | N b E | S S W | W S W | S 89 W | 5.0 | 7.6 | 4.6 | 2.46 | 6.00 | 0.051 | ... |
| 12 | .621 | .658 | .737 | .6772 | 63.0 | 77.8 | 61.6 | 67.88 | + 1.55 | .450 | .422 | .334 | .393 | .78 | .45 | .61 | .59 | W | W N W | N N W | N 49 W | 6.5 | 14.4 | 9.0 | 9.44 | 10.00 | ... | ... |
| 13 | .831 | .775 | .705 | .7712 | 56.9 | 71.3 | 59.0 | 63.15 | — 3.08 | .351 | .377 | .403 | .383 | .76 | .49 | .81 | .68 | N N W | S b E | S | S 5 E | 6.2 | 6.8 | 1.5 | 1.57 | 3.99 | ... | ... |
| 14 | .595 | .503 | .461 | .5163 | 59.4 | 62.7 | 61.9 | 62.17 | — 4 07 | .446 | .530 | .528 | .492 | .88 | .93 | .95 | .88 | N E | S W b S | W N W | S 77 W | 1.5 | 7.0 | 4.5 | 4.05 | 5.19 | 0.618 | ... |
| 15 | .551 | .634 | .743 | .6573 | 58.7 | 66.6 | 55.4 | 61.10 | — 5.05 | .407 | .286 | .295 | .323 | .82 | .43 | .67 | .61 | N N W | N W | N W | N 40 W | 7.5 | 13.0 | 1.8 | 8.51 | 8.92 | ... | ... |
| 16 | .858 | .898 | .921 | .8962 | 55.1 | 65.5 | 51.1 | 58.80 | — 7.23 | .320 | .454 | .299 | .368 | .73 | .72 | .80 | .73 | N b W | S W b S | N W b N | N 65 W | 4.5 | 8.2 | 3.0 | 2.15 | 4.52 | ... | ... |
| 17 | .947 | .864 | — | — | 49.0 | 70.2 | — | — | — | .297 | .430 | — | — | .85 | .58 | — | — | N N E | S | S S W | S | 1.8 | 10.6 | 3.0 | 3.42 | 3.92 | ... | ... |
| 18 | .739 | .662 | .683 | .6880 | 57.2 | 72.8 | 63.0 | 64.42 | — 1.42 | .381 | .503 | .462 | .459 | .81 | .62 | .80 | .76 | Calm. | S E b S | N | N 8 E | 0.0 | 6.0 | 9.0 | 2.27 | 4.76 | 0.420 | ... |
| 19 | .667 | .640 | .641 | .6500 | 59.8 | 71.7 | 60.5 | 64.97 | — 0.80 | .428 | .518 | .360 | .445 | .83 | .66 | .69 | .72 | N | S b E | Calm. | S 43 E | 4.2 | 4.5 | 0.0 | 1.79 | 3.28 | ... | ... |
| 20 | .693 | .666 | .687 | .6818 | 57.6 | 78.9 | 66.3 | 68.57 | + 3.02 | .376 | .646 | .508 | .517 | .79 | .65 | .78 | .73 | Calm. | S b E | N b W | N 59 W | 0.0 | 6.5 | 5.5 | 0.70 | 4.64 | ... | ... |
| 21 | .731 | .665 | .559 | .6222 | 62.3 | 72.4 | 68.4 | 68.85 | + 3.42 | .484 | .550 | .632 | .552 | .86 | .69 | .92 | .78 | N b E | E b S | E | S 81 E | 4.4 | 9.5 | 3.0 | 5.11 | 5.60 | 0.331 | ... |
| 22 | .425 | .353 | .450 | .4085 | 68.1 | 75.3 | 65.9 | 68.80 | + 3.45 | .637 | .694 | .399 | .580 | .93 | .79 | .62 | .81 | S b W | W S W | W b N | S 79 W | 1.8 | 10.0 | 10.8 | 5.68 | 7.55 | 0.433 | ... |
| 23 | .543 | .649 | .844 | .6870 | 60.1 | 70.6 | 56.5 | 62.55 | — 2.58 | .436 | .362 | .281 | .357 | .84 | .48 | .61 | .64 | W S W | N N W | N N W | N 25 W | 0.5 | 21.5 | 5.4 | 7.38 | 9.49 | ... | ... |
| 24 | .977 | .971 | — | — | 50.0 | 60.5 | — | — | — | .288 | .349 | — | — | .78 | .66 | — | — | N E b N | E N E | N N E | N 65 E | 6.5 | 7.5 | 4.0 | 4.97 | 5.79 | ... | ... |
| 25 | .775 | .662 | .609 | .6782 | 51.5 | 73.8 | 68.4 | 66.07 | + 1.33 | .274 | .475 | .590 | .463 | .71 | .57 | .85 | .70 | N b E | S | W N W | S 42 W | 3.0 | 5.8 | 4.8 | 2.93 | 3.62 | 0.038 | ... |
| 26 | .565 | .487 | .493 | .5042 | 64.1 | 83.2 | 69.2 | 72.68 | + 8.15 | .552 | .588 | .565 | .582 | .92 | .51 | .79 | .74 | Calm. | S W | W S W | S 79 W | 0.0 | 9.5 | 0.5 | 2.58 | 5.28 | 0.242 | ... |
| 27 | .479 | .493 | .463 | .4817 | 65.2 | 70.6 | 66.6 | 67.28 | + 2.97 | .577 | .603 | .586 | .596 | .92 | .80 | .90 | .89 | E b S | S E b E | S E b E | S 67 E | 2.5 | 5.2 | 5.5 | 1.51 | 4.05 | 0.293 | ... |
| 28 | .409 | .390 | .404 | .4005 | 64.8 | 75.3 | 66.6 | 69.45 | + 5.32 | .582 | .647 | .519 | .571 | .95 | .74 | .79 | .80 | N W b W | S W b S | W b S | N 60 W | 2.8 | 8.0 | 8.5 | 8.33 | 9.57 | ... | ... |
| 29 | .578 | .628 | .794 | .6810 | 56.9 | 69.9 | 55.8 | 61.00 | — 2.82 | .351 | .447 | .218 | .355 | .76 | .61 | .48 | .64 | N W | N W b W | N b W | N 27 W | 6.2 | 7.5 | 6.5 | 7.29 | 7.44 | ... | ... |
| 30 | .913 | .861 | .775 | .8477 | 48.2 | 64.5 | 54.7 | 57.43 | — 6.18 | .207 | .319 | .337 | .297 | .60 | .53 | .78 | .63 | N | S | S b W | S 13 W | 5.5 | 4.2 | 3.0 | 1.49 | 2.65 | ... | ... |
| 31 | .725 | .560 | — | — | 47.7 | 68.4 | — | — | — | .304 | .468 | — | — | .91 | .67 | — | — | N W b N | E | E b N | S 36 E | 2.0 | 7.0 | 3.5 | 2.58 | 5.46 | 0.656 | ... |
| M | 29.6290 | 29.6060 | 29.6169 | 29.6161 | 62.36 | 74.06 | 64.58 | 67.60 | + 1.84 | .479 | .552 | .482 | .510 | .82 | .65 | .77 | .74 | ........ | ........ | ........ | ........ | 3.74 | 8.74 | 4.55 | ...... | 5.96 | 3.483 | ...... |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR AUGUST, 1862.

Highest Barometer . . . . . . . 29.977 at 6 a. m. on 24th. } Monthly range=
Lowest Barometer . . . . . . . 29.326 at 6 a. m. on 9th. } 0.651 inches.

Self-registering Ther.
Maximum temperature . . . . 89°5 on p.m. of 6th } Monthly range=
Minimum temperature . . . . 42°8 on a.m. of 30th } 46°7
Mean maximum temperature . . 76°11 } Mean daily range=17°89
Mean minimum temperature . . 58°22 }
Greatest daily range . . . . . . 26°8 from a. m. to p. m. of 25th.
Least daily range . . . . . . . 7.3 from a. m. to p. m. of 27th.

Warmest day . . . 8th ...Mean Temperature . . .=79°08 } Difference=21°65.
Coldest day . . . . 30th ...Mean Temperature . . .=57°43 }
Maximum Radiation } Solar . . . . . . . . . . 104°5 on p.m of 8th } Monthly range=
} Terrestrial . . . . . . . . 33°0 on a. m. of 30th } 71°.5

Aurora observed on 9 nights, viz.: 9th, 13th, 18th, 19th, 23.d, 24th, 28th, 29th and 30th. Possible to see Aurora on 23 nights; Impossible on 8 nights.

Raining on 15 days; depth, 3·483 inches; duration of fall, 37.1 hours.

Mean of cloudiness=0.45; above the average, 0.00. Most cloudy hour observed, 2 p.m.; mean=0.57; least cloudy hour observed, 10 p.m.; mean=0.29.

*Sums of the components of the Atmospheric Current, expressed in Miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 1584.37 | 1334.41 | 755.46 | 1969.46 |

Resultant direction, N. 78° W.; Resultant Velocity, 1.67 miles per hour.
Mean velocity 5.96 miles per hour.
Maximum velocity 23.4 miles, from 3 to 4 p.m. on the 9th.
Most windy day 9th—Mean velocity 10.05 miles per hour.
Least windy day 30th—Mean velocity 2.65 miles per hour.
Most windy hour, 3 to 4 p.m.—Mean velocity, 9.51 miles per hour. } Difference
Least windy hour, 6 to 7 a.m.—Mean velocity, 3.45 miles per hour. } 6.06 miles.

2nd. Thunderstorm 10 to 11 a.m., and sheet lightning at night.—4th. Sheet lightning during the evening.—7th. Sheet lightning in N.W. at midnight.—8th. Very sultry day; sheet lightning in N.E. at 8 p.m.—11th. Slight thunderstorm 0.30 to 1.30 p m., and again from 7 to 10 p.m.—14th. Ground fog 9 to 10 p.m.—18th. Thunderstorm 1.40 to 3 p.m.—21st. Sheet lightning and distant thunder in W. at 11 p.m. and midnight.—22nd. Thunderstorm 3 to 10.30 a.m.; perfect rainbow at 6.30 p.m.—27th. Thunderstorm 2 to 5 a.m.; sheet lightning 9 p.m. to midnight.—28th. Dense wetting fog till 7 a.m.—30th. Hoar frost on footpaths at 6 a.m. (first of the season).—31st. Thunderstorm from 8 to 11 p.m.

Heavy dew recorded on 16 mornings during this month.

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30th. 9 p.m., Beautiful band of light ascending from West to within 10° of Zenith; its breadth was about 3°; it remained stationary upwards of fifteen minutes.

August, 1862, was comparatively mild, wet, and windy, and had exactly the mean amount of cloudiness.

### COMPARATIVE TABLE FOR AUGUST.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | Excess above Average, (66°0). | Maximum observed. | Minimum observed. | Range. | No. of days. | Inches. | No. of days. | Inches. | Resultant. Direction. | Resultant. Velocity. | Mean Velocity |
| 1840 | 64.7 | — 1.3 | 80.1 | 47.4 | 32.7 | 12 | 2.905 | ... | ... | ... | ... | ... |
| 1841 | 64.4 | — 1.6 | 83.5 | 46.7 | 36.8 | 9 | 6.170 | ... | ... | ... | ... | 0.19lbs |
| 1842 | 65.7 | — 0.3 | 80.7 | 45.3 | 35.4 | 6 | 2.500 | ... | ... | ... | ... | 0.30 " |
| 1843 | 66.4 | + 0.4 | 85.5 | 44.4 | 41.1 | 4 | 4.850 | ... | ... | ... | ... | 0.12 " |
| 1844 | 64.3 | — 1.7 | 82.5 | 44.3 | 38.2 | 17 | Imp. | ... | ... | ... | ... | 0.16 " |
| 1845 | 67.9 | + 1.9 | 82.5 | 44.4 | 38.1 | 9 | 1.725 | ... | ... | ... | ... | 0.19 " |
| 1846 | 68.4 | + 2.4 | 86.3 | 50.4 | 35.9 | 9 | 1.770 | ... | ... | ... | ... | 0.17 " |
| 1847 | 65.1 | — 0.9 | 83.1 | 44.9 | 38.2 | 10 | 2.140 | ... | ... | ... | ... | 0.19 " |
| 1848 | 69.2 | + 3.2 | 87.5 | 49.3 | 38.2 | 8 | 0.855 | ... | ... | S 21 E | 0.98 | 4.55ms. |
| 1849 | 66.3 | + 0.3 | 79.5 | 51.4 | 28.1 | 10 | 4.970 | ... | ... | N 71 W | 0.60 | 3.76 " |
| 1850 | 66.8 | + 0.8 | 84.2 | 43.0 | 41.2 | 13 | 4.355 | ... | ... | N 15 E | 0.35 | 4.46 " |
| 1851 | 63.6 | — 2.4 | 79.8 | 43.6 | 36.2 | 10 | 1.360 | ... | ... | N 63 W | 0.40 | 4.63 " |
| 1852 | 65.9 | — 0.1 | 81.2 | 46.7 | 34.5 | 9 | 2.695 | ... | ... | N 70 E | 0.56 | 3.30 " |
| 1853 | 68.6 | + 2.6 | 91.6 | 47.6 | 44.0 | 11 | 2.575 | ... | ... | S 36 E | 0.30 | 4.26 " |
| 1854 | 68.0 | + 2.0 | 98.1 | 47.0 | 51.1 | 5 | 0.455 | ... | ... | N 64 W | 1.76 | 4.60 " |
| 1855 | 64.1 | — 1.9 | 82.1 | 44.9 | 37.2 | 7 | 1.455 | ... | ... | N 63 W | 1.04 | 6.97 " |
| 1856 | 63.6 | — 2.4 | 81.3 | 44.0 | 37.3 | 12 | 1.680 | ... | ... | N 50 W | 2.88 | 7.03 " |
| 1857 | 65.9 | — 0.7 | 85.3 | 50.1 | 35.2 | 13 | 5.265 | ... | ... | N 77 W | 1.51 | 6.36 " |
| 1858 | 67.6 | + 1.6 | 83.4 | 45.4 | 38.0 | 11 | 3.890 | ... | ... | N 69 W | 1.57 | 6.50 " |
| 1859 | 66.6 | + 0.6 | 81.4 | 46.2 | 35.2 | 11 | 3.990 | ... | ... | N 36 W | 1.62 | 5.96 " |
| 1860 | 64.5 | — 1.5 | 81.8 | 47.1 | 34.7 | 14 | 3.405 | ... | ... | N 70 W | 1.83 | 5.80 " |
| 1861 | 65.5 | — 0.5 | 82.5 | 48.2 | 34.3 | 15 | 2.953 | ... | ... | N 8 E | 0.46 | 4.21 " |
| 1862 | 67.6 | + 1.6 | 87.6 | 47.7 | 39.9 | 15 | 3.483 | ... | ... | N 78 W | 1.67 | 5.96 " |
| Results to 1861. | 66.02 | ... | 83.81 | 46.47 | 37.35 | 10.2 | 2.951 | ... | ... | N 58 W | 0.85 | 5.17 |
| Diff. for 1862. | +1.58 | ... | + 3.79 | + 1.23 | + 2.55 | + 4.8 | + 0.532 | ... | ... | ... | ... | +0.79 |

## MONTHLY METEOROLOGICAL REGISTER, AT THE PROVINCIAL MAGNETICAL OBSERVATORY, TORONTO, CANADA WEST,—SEPTEMBER, 1862.

*Latitude*—43 *deg.* 39.4 *min. North. Longitude*—5 *h.* 17 *min.* 33 *sec. West. Elevation above Lake Ontario,* 108 *feet.*

| Day. | Barom. at temp. of 32°. | | | | Temp. of the Air. | | | | Excess of mean above Normal. | Tens. of Vapour. | | | | Humidity of Air. | | | | Direction of Wind. | | | Resultant Direction. | Velocity of Wind. | | | | | Rain in Inches. | Snow in Inches. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 6 A.M. | 2 P.M. | 10 P.M. | MEAN. | 6 A.M. | 2 P.M. | 10 PM | ME'N | | 6 A.M. | 2 P.M. | 10 P.M. | M'N | 6 A.M. | 2 P.M. | 10 P.M. | M'N | 6 A.M. | 2 P.M. | 10 P.M. | | 6 A.M. | 2 P.M. | 10 PM | Resul't. | ME'N | | |
| 1 | 29.129 | 29.116 | 29.316 | 29.1973 | 67.0 | 69.5 | 49.3 | 61.38 | − 1.65 | .623 | .576 | .293 | .484 | .93 | .79 | .83 | .84 | S W b S | N W b W | N W b N | N 54 W | 6.0 | 19.5 | 16.0 | 12.26 | 14.46 | ... | ... |
| 2 | .530 | .606 | .684 | .6172 | 43.9 | 55.8 | 42.5 | 47.45 | −15.28 | .218 | .228 | .227 | .221 | .75 | .50 | .83 | .68 | N N W | N W b N | N b W | N 27 W | 13.8 | 13.5 | 2.0 | 8.67 | 8.82 | ... | ... |
| 3 | .782 | .733 | .726 | .7417 | 41.0 | 61.9 | 59.1 | 55.50 | − 6.93 | .200 | .285 | .402 | .319 | .78 | .51 | .80 | .71 | N W | S b E | S | S 7 W | 4.0 | 7.0 | 2.4 | 2.84 | 3.19 | ... | ... |
| 4 | .691 | .675 | .687 | .6960 | 59.0 | 73.8 | 58.7 | 64.45 | + 2.32 | .428 | .574 | .457 | .483 | .86 | .69 | .93 | .80 | W S W | S S W | Calm. | S 28 W | 2.2 | 11.5 | 0.0 | 5.65 | 5.71 | ... | ... |
| 5 | .709 | .619 | .561 | .6237 | 58.3 | 78.9 | 69.5 | 69.32 | + 7.48 | .472 | .659 | .575 | .557 | .97 | .67 | .79 | .78 | Calm. | S b W | S W | S 27 W | 0.0 | 9.4 | 2.0 | 3.47 | 3.58 | 0.800 | ... |
| 6 | .584 | .547 | .543 | .5550 | 66.6 | 76.0 | 65.9 | 69.63 | + 8.20 | .628 | .731 | .609 | .664 | .96 | .81 | .95 | .92 | S S W | S W b S | E b N | S 22 W | 6.4 | 8.8 | 1.8 | 1.68 | 2.41 | 0.560 | ... |
| 7 | .507 | .499 | — | — | 65.9 | 74.6 | — | — | — | .609 | .656 | — | — | .95 | .77 | — | — | S S E | S W b S | S W | S 37 W | 2.0 | 15.5 | 6.0 | 7.52 | 7.67 | 0.040 | ... |
| 8 | .472 | .499 | .713 | .5678 | 65.9 | 74.6 | 61.2 | 67.27 | + 6.53 | .595 | .373 | .374 | .450 | .93 | .43 | .69 | .68 | S W | W b N | N W | N 79 W | 5.0 | 18.0 | 12.0 | 8.76 | 9.87 | ... | ... |
| 9 | .860 | .898 | .865 | .8790 | 50.8 | 64.8 | 54.4 | 57.97 | − 2.38 | .324 | .463 | .373 | .398 | .87 | .75 | .88 | .82 | Calm. | S | Calm. | N 64 E | 0.0 | 1.5 | 0.0 | 1.14 | 2.09 | .. | ... |
| 10 | .891 | .848 | .791 | .8368 | 52.6 | 67.0 | 60.1 | 61.03 | + 0.98 | .310 | .486 | .413 | .403 | .78 | .73 | .79 | .74 | N E b N | E b S | N N E | N 77 E | 3.0 | 6.5 | 3.0 | 2.42 | 2.87 | ... | ... |
| 11 | .758 | .677 | .619 | .6690 | 55.1 | 73.1 | 68.8 | 66.22 | + 6.57 | .353 | .570 | .584 | .508 | .82 | .70 | .83 | .78 | N E b N | E | S E b E | S 69 E | 2.0 | 7.0 | 0.5 | 2.12 | 3.18 | 0.007 | ... |
| 12 | .519 | .669 | .859 | .6963 | 66.6 | 65.5 | 54.0 | 61.55 | + 2.32 | .614 | .352 | .367 | .430 | .93 | .56 | .83 | .77 | S W | N W b N | N b W | N 27 W | 1.5 | 18.8 | 9.6 | 10.97 | 11.64 | 0.005 | ... |
| 13 | 30.003 | .996 | .943 | .9805 | 45.0 | 53.6 | 46.4 | 48.70 | −10.15 | .258 | .287 | .269 | .280 | .86 | .69 | .85 | .81 | N E b N | S E | N E | N 68 E | 3.6 | 4.0 | 3.0 | 2.67 | 3.75 | ... | ... |
| 14 | 29.926 | .879 | — | — | 47.9 | 60.5 | — | — | — | .288 | .303 | — | — | .86 | .57 | — | — | N | S b W | E | N 12 E | 5.5 | 5.0 | 1.2 | 0.82 | 2.23 | ... | ... |
| 15 | .818 | .717 | .831 | .7863 | 48.6 | 61.9 | 57.6 | 57.48 | − 0.43 | .312 | .515 | .434 | .437 | .91 | .93 | .92 | .91 | N | Calm. | N b E | N 22 E | 3.5 | 0.0 | 7.8 | 2.72 | 4.06 | 0.037 | ... |
| 16 | .872 | .835 | .785 | .8280 | 55.1 | 60.9 | 54.4 | 56.97 | − 0.55 | .343 | .366 | .385 | .366 | .78 | .68 | .91 | .79 | N E b E | E b S | Calm. | N 83 E | 3.5 | 8.0 | 0.0 | 3.59 | 3.98 | ... | ... |
| 17 | .706 | .599 | .446 | .5727 | 56.5 | 64.8 | 65.9 | 62.82 | + 5.82 | .425 | .542 | .581 | .514 | .93 | .88 | .91 | .89 | N E | E | E b N | N 86 E | 2.0 | 9.4 | 3.5 | 5.81 | 6.34 | ... | ... |
| 18 | .328 | .456 | .540 | .4582 | 67.0 | 73.5 | 61.2 | 66.75 | +10.13 | .594 | .564 | .486 | .542 | .90 | .68 | .90 | .83 | S S W | W b S | N W b W | S 80 W | 5.0 | 10.0 | 4.0 | 5.72 | 6.77 | 0.195 | ... |
| 19 | .692 | .759 | .804 | .7650 | 56.5 | 65.4 | 54.7 | 58.30 | + 2.18 | .413 | .442 | .315 | .381 | .90 | .71 | .73 | .77 | W N W | S W b S | N b W | N 82 W | 4.2 | 7.8 | 6.0 | 2.81 | 4.86 | ... | ... |
| 20 | .783 | .714 | .774 | .7505 | 51.5 | 65.5 | 56.2 | 58.22 | + 2.62 | .325 | .422 | .417 | .396 | .85 | .67 | .93 | .82 | N | S S W | Calm. | S 32 W | 0.5 | 11.5 | 0.0 | 2.69 | 3.85 | ... | ... |
| 21 | .865 | .877 | — | — | 55.8 | 64.1 | — | — | — | .400 | .499 | — | — | .90 | .83 | — | — | N | E S E | Calm. | S 83 E | 3.0 | 2.5 | 0.0 | 2.80 | 3.00 | ... | ... |
| 22 | .800 | .744 | .735 | .7565 | 51.5 | 73.5 | 58.3 | 62.07 | + 7.43 | .367 | .593 | .436 | .473 | .97 | .72 | .90 | .85 | Calm. | S b E | Calm. | S 10 W | 0.0 | 7.5 | 0.0 | 2.28 | 2.62 | ... | ... |
| 23 | .701 | .579 | .421 | .5567 | 54.4 | 73.8 | 65.5 | 64.75 | +10.53 | .396 | .533 | .506 | .488 | .93 | .63 | .80 | .80 | N b E | S b W | S W | S 80 W | 2.0 | 11.0 | 4.0 | 2.63 | 7.29 | 0.385 | ... |
| 24 | .575 | .695 | .737 | .6815 | 54.4 | 59.4 | 47.5 | 53.40 | − 0.35 | .396 | .200 | .255 | .270 | .93 | .39 | .77 | .68 | N b W | N N W | N N W | N 17 W | 12.0 | 12.0 | 2.0 | 6.73 | 6.82 | ... | ... |
| 25 | .760 | .722 | .707 | .7302 | 45.0 | 63.0 | 53.6 | 54.58 | + 1.35 | .230 | .424 | .340 | .333 | .77 | .73 | .82 | .77 | N W b N | S | W N W | S 26 W | 2.2 | 8.5 | 2.0 | 3.55 | 4.38 | ... | ... |
| 26 | .733 | .722 | .705 | .7195 | 47.1 | 66.6 | 58.0 | 57.48 | + 4.75 | .299 | .490 | .382 | .378 | .92 | .75 | .79 | .78 | W N W | S S W | N W | S 28 W | 1.0 | 8.5 | 3.0 | 2.63 | 2.99 | ... | ... |
| 27 | .733 | .685 | .642 | .6823 | 46.8 | 64.8 | 56.5 | 57.42 | + 5.20 | .295 | .425 | .425 | .395 | .92 | .70 | .93 | .84 | N | E b S | Calm. | N 84 E | 1.2 | 2.0 | 0.0 | 0.61 | 1.04 | ... | ... |
| 28 | .602 | .531 | — | — | 52.2 | 69.5 | — | — | — | .358 | .507 | — | — | .92 | .70 | — | — | N N E | S S E | Calm. | S 8 E | 0.5 | 2.0 | 0.0 | 0.66 | 1.50 | ... | ... |
| 29 | .540 | .578 | .675 | .6115 | 57.6 | 65.2 | 52.6 | 58.83 | + 7.57 | .410 | .470 | .321 | .415 | .86 | .75 | .80 | .82 | N W b N | N | N b E | N 6 E | 2.5 | 14.5 | 4.0 | 6.19 | 6.71 | ... | ... |
| 30 | .740 | .820 | .835 | .7993 | 49.0 | 50.0 | 50.4 | 49.63 | − 1.18 | .317 | .294 | .278 | .293 | .91 | .81 | .76 | .82 | N E | E N E | E | N 64 E | 4.0 | 1.5 | 9.5 | 5.08 | 5.52 | 0.315 | ... |
| ... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ...... | ... | ... | ... | ... | ... | ... | ... | .. | .......... | .......... | .......... | .......... | ...... | ...... | ...... | ...... | ...... | ...... | ... |
| M | 29.6811 | 29.6734 | 29.6902 | 29.6830 | 54.34 | 66.26 | 57.01 | 59.59 | + 2.10 | .390 | .456 | .404 | .418 | .88 | .69 | .84 | .80 | .......... | .......... | .......... | .......... | 3.47 | 8.76 | 3.51 | ...... | 5.11 | 2.344 | ...... |

## REMARKS ON TORONTO METEOROLOGICAL REGISTER FOR SEPTEMBER, 1862.

Highest Barometer........................ 30.031 at 8 a. m. on 13th } Monthly range =
Lowest Barometer ........................ 29.107 at 8 a. m. on 1st } 0.924 inches.
Self-regist'ing Thermom. { Maximum Temperature ............... 79°4 on p.m. of 5th } Monthly range =
Minimum Temperature ............... 39°0 on a.m. of 3rd } 40°4
Mean maximum Temperature ...................... 68°43 } Mean daily range =
Mean minimum Temperature ...................... 52°77 } 15°66
Greatest daily range ............ 25°8 from a. m. to p.m. of 3rd.
Least daily range.................. 5°6 from a. m. to p. m. of 12th.
Warmest day......... 6th... Mean temperature......... 69°63 } Difference = 22°18.
Coldest day ........... 2nd... Mean temperature......... 47°45 }
Maximum { Solar.......................................93°0 on p.m. of 5th } Monthly range =
Radiation. { Terrestrial ..................................32°2 on a.m. of 3rd } 60°8

Aurora observed on 8 nights, viz.,—1st, 2nd, 9th, 19th, 24th, 25th, 26th, and 27th.
Possible to see Aurora on 19 nights; impossible on 11 nights.
Snowing on 0 days, depth ... inches; duration of fall, ... hours.
Raining on 9 days,—depth 2.344 inches; duration of fall 29.7 hours.
Mean of cloudiness = 0.47. Below average 0.03.
Most cloudy hour observed, 6 a. m., mean = 0.56; least cloudy hour observed, 4 p. m.; mean, = 0.38.

---

*Sums of the components of the Atmospheric Current, expressed in miles.*

| North. | South. | East. | West. |
|---|---|---|---|
| 1494.21 | 1103.41 | 710.48 | 1373.19 |

Resultant direction N. 59° W.; Resultant velocity 1.07 miles per hour.
Mean velocity ............................5.11 miles per hour.
Maximum velocity ..................... 23.7 miles, from 4 to 5 p. m. on 1st.
Most windy day ......1st ............Mean velocity, 14.46 miles per hour. } Difference =
Least windy day......27th ............Mean velocity, 1.04 ditto. } 13.42 miles.
Most windy hour ...2 p.m. to 3 p.m. .........Mean velocity, 9.40 ditto. } Difference =
Least windy hour...4 a.m. to 5 a.m. .........Mean velocity 2.97 ditto. } 6.43 miles.

---

3rd. Hoar frost at 6 a.m.—4th. The comet visible to the naked eye, but very indistinct.—6th. Thunderstorm 5 to 6 p.m.; dense fog at night.—11th. Sheet lightning in W. and S. W. during the evening.—15th. Heavy dew and light ground fog at 6 a.m.—22nd. Very dense fog till 8 a.m.; fog-bow at 7.10 a.m., perfect, but exhibiting no prismatic colours.—23rd. Heavy dew and light ground fog at 6 a m.; sheet lightning 7.30 to 11.30 p.m.—25th. Hoar frost at 6 a.m.—27th. Heavy dew and slight fog at 6 a.m.; solar halo at 3.20 p.m.; fog at 10 p.m.—28th. Sheet lightning 7 to 9 p.m.

---

Heavy Dew recorded on 13 mornings during the month.

September, 1862, was comparatively mild, dry, calm, and clear.

---

### COMPARATIVE TABLE FOR SEPTEMBER.

| YEAR. | TEMPERATURE. | | | | | RAIN. | | SNOW. | | WIND. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Mean. | Excess above aver'ge (57.9) | Max. ob-served. | Min. ob-served. | Range. | No. of days. | Inches | No. of days. | Inches | Resultant. Direction. | Resultant. V'y. | Mean Force or Velocity. |
| 1840 | ° 54.0 | ° — 3.9 | ° 70.2 | ° 29.4 | ° 40.8 | 4 | 1.380 | 0 | ... | ... | ... | ........... |
| 1841 | 61.3 | + 3.4 | 79.9 | 37.5 | 42.4 | 9 | 3.340 | 0 | ... | ... | ... | 0.26 lbs. |
| 1842 | 55.7 | — 2.2 | 83.5 | 28.3 | 55.2 | 12 | 6.160 | 0 | ... | ... | ... | 0.45 |
| 1843 | 59.1 | + 1.2 | 87.8 | 33.1 | 54.7 | 10 | 9.760 | 0 | ... | ... | ... | 0.57 |
| 1844 | 58.6 | + 0.7 | 81.5 | 29.6 | 51.9 | 4 | Imp. | 0 | ... | ... | ... | 0.26 |
| 1845 | 56.0 | — 1.9 | 78.8 | 35.3 | 43.5 | 16 | 6.245 | 0 | ... | ... | ... | 0.34 |
| 1846 | 63.6 | + 5.7 | 84.0 | 39.0 | 45.0 | 11 | 4.595 | 0 | ... | ... | ... | 0.33 |
| 1847 | 55.6 | — 2.3 | 74.8 | 38.1 | 36.7 | 15 | 6.665 | 0 | ... | ... | ... | 0.33 |
| 1848 | 54.2 | — 3.7 | 80.9 | 29.5 | 51.4 | 11 | 3.115 | 0 | ... | N 71° W | 2.38 | 5.81mls. |
| 1849 | 58.2 | + 0.3 | 80.6 | 33.5 | 47.1 | 9 | 1.480 | 0 | ... | N 75° W | 0.69 | 4.23 |
| 1850 | 56.5 | — 1.4 | 76.0 | 31.7 | 44.3 | 11 | 1.735 | 0 | ... | S 65° W | 1.02 | 4.78 |
| 1851 | 60.0 | + 2 1 | 86.3 | 33.4 | 52.9 | 9 | 2.665 | 0 | ... | N 14° E | 1.03 | 5.45 |
| 1852 | 57.5 | — 0.4 | 81.8 | 36.1 | 45.7 | 10 | 3.630 | 0 | ... | N 77° W | 0.53 | 4.60 |
| 1853 | 58.8 | + 0.9 | 85.4 | 36.1 | 49.3 | 12 | 5.140 | 0 | ... | N | 1.06 | 4.33 |
| 1854 | 61.0 | + 3.1 | 93.1 | 36.3 | 56.8 | 14 | 5.375 | 0 | ... | N 22° W | 1.33 | 4.04 |
| 1855 | 59.5 | + 1.6 | 81.7 | 36.1 | 45.6 | 12 | 5.585 | 0 | ... | N 20° E | 1.29 | 7.61 |
| 1856 | 57.1 | — 0.8 | 77.3 | 37.4 | 39.9 | 13 | 4.105 | 0 | ... | S 79° W | 1.98 | 6.53 |
| 1857 | 58.6 | + 0.7 | 81.4 | 34.1 | 47.3 | 11 | 2.640 | 0 | ... | N 68° W | 1.61 | 5.55 |
| 1858 | 59.1 | + 1.2 | 80.1 | 36.8 | 43.3 | 8 | 0.735 | 0 | ... | S 74° W | 1.53 | 5.69 |
| 1859 | 55.2 | — 2.7 | 73.8 | 35.7 | 38.1 | 15 | 3.525 | 0 | ... | N 44° W | 1.60 | 6.36 |
| 1860 | 55.3 | — 2.6 | 74.2 | 28.7 | 45.5 | 14 | 1.959 | 0 | ... | N 71° W | 2.63 | 5.79 |
| 1861 | 59.1 | + 1.2 | 78.2 | 37.1 | 41.1 | 17 | 3.607 | 0 | ... | N 71° W | 1.39 | 4.81 |
| 1862 | 59.6 | + 1.7 | 78.9 | 41.0 | 37.9 | 9 | 2.344 | 0 | ... | N 59° W | 1.07 | 5.11 |
| Results to 1861. | 57.91 | ... | 80.51 | 34.22 | 46.30 | 11.2 | 3.973 | ... | ... | N 62° W | 1.13 | 5.40 |
| Diff. for 1862. | + 1.68 | ... | — 1.61 | + 6.78 | — 8.40 | — 2.2 | — 1.629 | ... | ... | ......... | ...... | — 0.29 |

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